USAMRMC Products Portfolio

June 2005

U.S. Army Medical Research and Materiel Command

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Introduction

USAMRMC

The nation's military forces may be called to serve anywhere in the world during times of conflict or in peacetime. Among the threats our forces face are injury from combat operations, exposure to chemical or biological warfare agents, environmental extremes, and endemic diseases not common in the United States. To provide warfighters defenses against these hazards and sustain their health is the goal of the U.S. Army Medical Research and Materiel Command (USAMRMC).

A complex and diverse organization, the Command sustains the health and fighting ability of Soldiers, Sailors, Airmen, and Marines through its programs in medical research, medical materiel development, medical logistics and facility planning, medical information systems, and development of new technologies to improve military health care on the battlefield. The Command is engaged in a broad spectrum of activity, from basic research in the laboratory, to innovative product acquisition, to the fielding and life-cycle management of medical equipment and supplies for deploying units.

Six laboratories make up the Command's core science and technology capability. They are centers of excellence in specific areas of biomedical research, staffed by highly qualified military and civilian scientists and support personnel. A large extramural contract research program and numerous cooperative research and development agreements with leading research and development organizations in the civilian sector complement the Command's in-house science and technology capabilities.

The USAMRMC Office of Congressionally Directed Medical Research Programs (CDMRP) manages targeted biomedical research programs mandated by Congress. The mission of the CDMRP is to promote innovative research, recognize untapped opportunities, create partnerships, and guard the public trust in these target areas. An important program within CDMRP is the Peer Reviewed Medical Research Program (PRMRP) which manages projects aimed directly in support of military health and wellbeing. Many of the projects funded by the PRMRP have begun to yield combat health support technologies and products, thus complementing the current USAMRMC Core priorities.

This portfolio provides a comprehensive listing of the products the USAMRMC provides or plans to deliver to protect and treat warfighters who serve the nation. Products the Command develops fall into five groups: military infectious diseases, combat casualty care, military operational medicine, medical chemical and biological defense, and information technology. The last group includes advances in telemedicine, information technology, medical logistics, and facility planning. These five categories serve as the framework by which this book is organized. An overview of each group's mission and challenges precedes the group's current product listing.

Products are described as promising, future, or completed. Promising products are those closest to being put in the Soldiers' or medical professionals' hands. These are the products that have crossed the boundary from the lab to advanced development. For example, vaccines and drugs in clinical trials and devices that are being evaluated and modified to fit users' needs are considered promising. One caveat is necessary here: When a vaccine or drug moves to the different phases of clinical trials, planners expect certain fail rates. For example, half the drugs in Phase 1 trials don't make it to Phase 2 trials, and a third don't make it from Phase 2 to Phase 3 trials.

Future products are in basic research in the labs. Some are in their early stages; some are awaiting funding to make the leap into advanced development. Completed products in the portfolio are a sample of the Command's success stories. They made it through the advanced development process and into the procurement system and can be purchased by units.

Two appendices also provide valuable information on the Command's products. To give the reader an appreciation of the myriad advances the Command's scientists have made over the years, Appendix A lists the patents the Command holds or held before they expired as well as a list of current licensing agreements. Appendix B provides a list of some of the commercial, off-the-shelf technology the Command has fielded to support the warfighter.

Appendix C lists Small Business Innovative Research projects that are in Phase II and intended to result in a dual-use technology, product, or service.

Appendix D provides a list of acronyms that are used throughout the book.

Military Infectious Diseases

Combat Casualty Care

Military Operational Medicine

Medical Chemical and Biological Defense

Telemedicine, Logistics, IM/IT, and Facilities

Overview

Infectious diseases debilitate Soldiers and can influence battle outcome. Infectious diseases in the military cause lost duty time; increase the medical logistical burden for diagnosis, treatment, and evacuation; and decrease combat effectiveness.

Many hospital admissions among U.S. Soldiers in Vietnam were attributed to infectious diseases, including malaria, dengue, scrub typhus, and Japanese encephalitis. Dengue and malaria caused hospitalizations in Somalia, and dengue and diarrhea afflicted troops in Haiti. Diarrhea remains a major cause of illness among deployed service members supporting Operation Enduring Freedom in Afghanistan and Operation Iraqi Freedom in the Persian Gulf. Additional infectious disease threats to servicemen and women include hepatitis, leishmaniasis, meningococcal disease, human immunodeficiency virus (HIV), hantavirus infections, and other hemorrhagic fever viruses. Many environments to which Soldiers deploy harbor specific infectious disease hazards.

The Military Infectious Diseases Research Program (MIDRP) focuses on prevention, diagnosis, and treatment of naturally occurring microorganism-borne disease with major potential to reduce mission effectiveness. Research emphasis includes the following:

- Developing vaccines against infectious diseases of military importance,
- Discovering and developing drugs to prevent and treat infection,
- Creating techniques to identify disease-causing microorganisms and diagnose infections rapidly,
- Collecting and analyzing epidemiological data to optimize infectious disease control strategy, and
- Evaluating methods to control vectors (arthropods that carry disease-producing microorganisms) of relevant infectious diseases.

The program is enhanced by numerous facilities, including eight infectious disease research laboratories around the world, accredited animal and biosafety level four containment laboratories, a pilot vaccine facility, and clinical trials units. Most of the associated 330 scientists (employed by the military, civil service, or contracting companies) have advanced degrees. The program maximizes research dollars by collaborating with industry and universities through more than 100 cooperative research and development agreements.

Vaccines

The discovery and development of vaccines to protect the warfighter are priorities for the MIDRP. Vaccines can be administered prior to deployment, thereby obviating the need for prophylactic medication while protecting service members and reducing the medical logistic burden. Since the passing of the 1962 Kefauver-Harris Drug Amendment, which added the U.S. Food and Drug Administration's (FDA's) requirement for proof of efficacy in addition to proof of safety for human products, there have been 28 innovative vaccines licensed in the United States, including 13 vaccines currently designated for pediatric use. These 28 innovative vaccine products targeted new microorganisms, utilized new technology, or consisted of novel combinations of vaccines. Of these 28, the U.S. military played a significant role in the development of 7 licensed vaccines (25% of the total, or 40% if pediatric vaccines are excluded):

- Rubella (1969),
- Adenovirus 4 & 7 vaccines (1980),
- Tetravalent meningococcal vaccine (1981),
- Hepatitis B vaccine (1981),
- Oral typhoid vaccine (1989),
- Japanese encephalitis vaccine (1992), and
- Hepatitis A vaccine (1995).

More than half of the routine vaccines given to service members were co-developed by the military. Development of other vaccines was supervised by investigators who began their careers at military research centers (e.g., yellow fever vaccine by former Army Surgeon General William Gorgas; mumps, measles, and varicella vaccines by Maurice Hilleman; and oral polio vaccine by Albert Sabin). Vaccines currently in advanced development stages include new adenovirus vaccines, as well as vaccines for malaria, dengue, and hepatitis E.

Drugs

The MIDRP has contributed to the development of all synthetic drugs licensed in the United States for the prevention and treatment of malaria, including:

- Chloroquine (1949),
- Primaquine (1952),
- Chloroquine-primaquine (combined drug, 1969),
- Sulfadoxine-pyrimethamine (1983),
- Mefloquine (1989),
- Doxycycline (1992),
- Halofantrine (1992), and
- Atovaquone-proguanil (2000).

MIDRP researchers also developed the current dosing regimen for treating cutaneous leishmaniasis with the drug pentostam.

Diagnostics and Vector Control

MIDRP products include fieldworthy devices to diagnose human infections rapidly (such as scrub typhus) and determine if insects are carrying infectious agents transmissible to humans (such as malaria parasites and West Nile virus). Additional products include insect repellents and a camouflage face paint/insect repellent and computer-based systems to identify potentially disease-carrying insects in the field.

Other Contributions

Licensed products reflect only a small portion of the contributions of the U.S. military to infectious diseases research. Contributions range from the demonstration that yellow fever was transmitted by a virus by Major Walter Reed in 1900 to the treatment of cholera by Captain R.A. Phillips in the 1940s (which led to development of oral rehydration solution) to the publication of the complete malaria genome in 2000. U.S. military physicians have authored and co-authored thousands of research publications elucidating the etiology, ecology, epidemiology, and pathophysiology of many infectious diseases leading to effective treatment and control measures. Additionally, long-term deployment of military scientists to Department of Defense (DoD) laboratories in the tropics over the last 100 years has accelerated scientific discoveries and product development and assisted technology transfer of research techniques and tropical disease control measures to developing countries.

Specific MIDRP Areas

Diarrheal Diseases

Diarrhea afflicts up to 50% of troops deployed to high-risk areas. Currently, no guaranteed protective measures exist, and the global problem of antimicrobial-resistant, diarrhea-causing microorganisms may limit treatment options. Candidate vaccines for major causes of bacterial diarrhea are being developed and evaluated by the MIDRP.

Drugs to Prevent and Treat Malaria

Malaria is rated the most important infectious disease threat facing U.S. troops worldwide. Malaria may cause severe illness and death among U.S. service members sent to tropical and some subtropical regions. The malaria threat is exemplified by the recent experience of 225 Marines briefly deployed to Liberia. Falciparum malaria was identified in 80 Marines, and 5 persons were noted to have severe and complicated infections. The MIDRP is developing new drugs to prevent infection and accelerate recovery from severe and multidrug-resistant infections. Because malaria parasites eventually develop mechanisms to resist the effect of antimalarial drugs, each drug is only useful for approximately 10-15 years, necessitating continuous replacement drug development efforts.

Malaria Vaccines

The MIDRP is developing vaccines to protect against *Plasmodium falciparum* as a long-term solution for the most significant infectious disease threat to U.S. forces. A vaccine will improve Soldier performance and morale by avoiding drug side effects, drug compliance issues, and malaria casualties. The medical logistic burden associated with drug prophylaxis, diagnosis, evacuation, hospitalization, and intensive treatment will be reduced.

Malaria Genome Project

MIDRP researchers, in collaboration with partners, successfully completed genome sequencing of malaria parasites *(P. falciparum, P. vivax,* and *P. yoelii)*. Application of these results will aid in the discovery of drugs and vaccines to prevent and treat malaria.

Scrub Typhus Vaccine

Scrub typhus is caused by a bite from an infected mite or chigger and can cause fever and rash with a long convalescence or death. The disease is prevalent in Asia, Australia, and many Pacific Islands. Outbreaks occurred in the U.S. military in 2001. The MIDRP is developing a vaccine that can protect individuals from multiple strains of scrub typhus.

Dengue Fever Vaccine

Dengue fever is a painful viral disease caused by a bite from an infected mosquito. Dengue is a leading cause of hospital admission in units operating in the tropics. There is currently no vaccine or drug to prevent the disease. The MIDRP manages a program focusing on pathogenesis studies, diagnostics, and vaccine development to protect against the four types of dengue virus.

Lethal Virus Countermeasures

Hantaviruses are usually transmitted to humans via aerosols created by infected rodent excreta. The four distinct hantaviruses that cause hemorrhagic fever with renal syndrome (HFRS) are endemic throughout Asia and Europe. There have been thousands of occurrences of HFRS causing illness (often necessitating evacuation and extensive long-term care) and death. The MIDRP is pursuing DNA vaccines to prevent HFRS as well as methods to prevent and treat other hemorrhagic viruses such as Lassa fever and Rift Valley fever.

Diagnostic Systems

There is an urgent demand for field-worthy methods for rapid diagnosis of infectious diseases. This is particularly relevant given concerns about biological warfare. Timely and accurate diagnosis will permit appropriate medical treatments and other protective measures. MIDRP scientists are developing scientific assay sets suitable for a variety of assay platforms.

Meningococcus Type B Vaccine

Meningitis is a bacterial disease transmitted by human aerosol and is potentially life threatening or permanently debilitating. The threat to service members primarily occurs during basic training but is also prevalent in sub-Saharan Africa, South America, and Asia. Even a single case can be disruptive to troops. The DoD successfully developed meningococcal vaccines for types A, C, Y, and W-135. The MIDRP effort is now focused on type B.

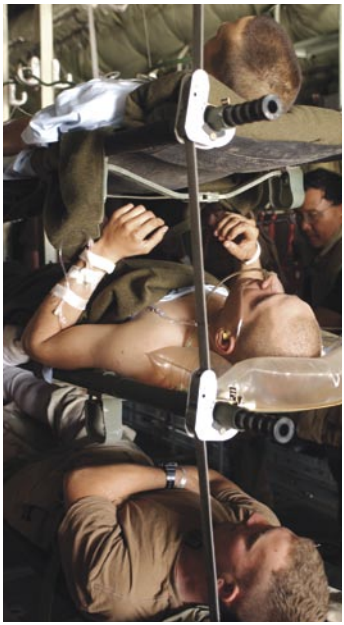
Identification, Control of Insect Vectors

Seventy percent of Soldiers experience problems related to biting insects. The current military repellent is a greasy compound that dissolves plastic, is removed by abrasion or wetting, and is not popular with Soldiers. The MIDRP is developing a new standard military insect repellent that is effective and user acceptable.

Military HIV Research Program

Military personnel can become infected by HIV via blood transfusions, accidental blood exposure while providing humanitarian assistance, or sexual exposure. HIV impacts troop strength of U.S. and allied forces and the political and economic stability of developing nations. Research focuses on the development of a global HIV-1 vaccine. Field sites have been established in Uganda, Kenya, Tanzania, and Thailand. Research management is shared by the MIDRP, Advanced Development programs of USAMRMC, and the National Institutes of Health's National Institute of Allergy and Infectious Diseases (NIAID).

Adenovirus Vaccine, Types 4 and 7



Mission

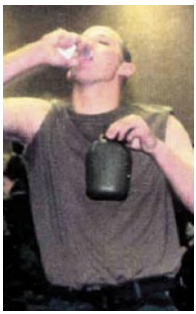
The Adenovirus Vaccine will prevent adenovirus-related acute respiratory disease (ARD) in Soldiers, Sailors, Airmen, and Marines living in barrack-type environments during basic training resulting in decreased recycling of recruits and considerable cost savings.

Description

Adenoviruses are associated with pharyngitis, conjunctivitis, atypical pneumonia, and rhinitis. Prior to the use of vaccines, adenovirus types 4 and 7 accounted for 60% of all ARDs in hospitalized military recruits. Nearly 90% of military recruits are susceptible to either adenovirus type 4 or 7, and since 1999 there have been several adenovirus-related outbreaks with associated hospitalizations and some deaths.

The Adenovirus Vaccine is an orally administered enteric-coated tablet containing live adenovirus serotypes 4 or 7 and is used almost exclusively by the military.

An earlier highly effective version of this vaccine was approved for distribution in 1980; however, production ceased in 1995 due to costly manufacturing facility upgrade requirements. This new product will serve as a replacement in an effort to once again prevent ARD in the military.



Laboratory/Developer

Duramed (A subsidiary of Barr Pharmaceuticals, Inc.)

U.S. Army Medical Materiel Development Activity (USAMMDA)

Product Status: **PROMISING** ◆ FUTURE ◆ COMPLETED

Subcategory: ***Prevention***

Combined Camouflage Face Paint (CCFP)

Mission

The CCFP with DEET insect repellent will improve Soldier survivability and sustainability in regions of the world where biting insects transmit diseases.

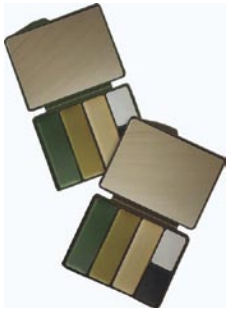
Description

Inclusion of insect repellent protection will reduce nuisance factors by repelling insects near the face and help reduce diseases (e.g., malaria and dengue fever) transmitted by biting insects. The new CCFP will be a blend of face paint with DEET insect repellent to provide a minimum of 8 hours of protection against biting insects.

The new CCFP will be packaged in a compact container with a mirror on top and compartments on the bottom to provide 20 applications of the loam, green, and sand colors and 10 applications of the black and white colors. All CCFP formulations will be used by individual service members for protection against biting insects, protection against detection by night vision goggles (the face paint reduces a Soldier's near-infrared signature), and assimilation into the military theater environment.

Laboratory/Developer

Iguana LLC; Natick Soldier Center
USAMMDA



Tick-Borne Encephalitis (TBE) Virus Vaccine

Mission

The TBE Virus Vaccine will prevent tick-borne encephalitis in military service members who are deployed to endemic areas of several European countries, Russia, and China.

Description

The highly pathogenic TBE virus is transmitted through a tick bite. After a 7- to 14-day incubation period, the disease is characterized by up to 4 days of low-grade fever and flu-like symptoms. Encephalitis follows in up to 30% of infected individuals and can require many weeks of hospitalization and rehabilitation. Mortality is typically 2% but can be as high as 23% in the Far East.

The TBE Virus Vaccine will increase the survivability and sustainability of U.S. forces in endemic regions. It has been used in Europe for over 20 years but is not yet licensed in the United States as it is cost prohibitive for commercial vaccine manufacturers.

Laboratory/Developer

USAMMDA

Product Status: **PROMISING** ◆ FUTURE ◆ COMPLETED

Subcategory: ***Therapeutics***

Diarrheal Disease Supplement

Mission

Rehydration and antibiotic treatment are the cornerstones of disease management, but even with early institution of appropriate therapy, diarrheal diseases exact a cost in terms of lost duty and effectiveness. An effective supplement that will aid in the treatment of diarrheal disease will enhance the sustainability of Soldiers in regions of the world where diarrheal illnesses and dysentery are endemic.

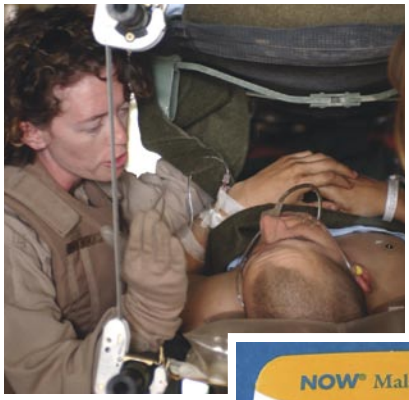
Description

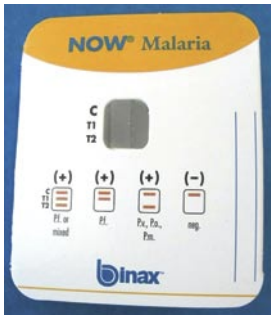
There is no licensed drug or biologic that provides a safe, effective mode of prevention against diarrheal diseases, leaving an important deficiency in military and travel medicine. This project is developing bovine milk immunoglobulins as a supplement with activity against enterotoxigenic *Escherichia coli* (ETEC), the predominant cause of traveler's diarrhea. This investigational treatment has shown proof of principle as a safe, food-based antidiarrheal supplement and is slated to begin clinical trials in 2005.

Laboratory/Developer

Congressionally Directed Medical Research Programs (CDMRP)
Naval Medical Research Center (NMRC)

Malaria Rapid Diagnostic Device (MRDD)





Mission

Malaria constitutes a serious infectious disease threat to U.S. forces in times of war and peace in most tropical and some subtropical regions of the world. The MRDD permits field diagnosis of malaria infection and early intervention.

Description

Malaria is a potentially fatal illness with the ability to quickly incapacitate large numbers of personnel. Diagnosis must be rapid to initiate proper therapy in infected persons and prevent infection in others.

The MRDD is a field-deployable, handheld, disposable point-of-care test to detect the presence of malaria parasites in blood samples of persons displaying symptoms compatible with malaria. The MRDD kits (not yet approved by the FDA) are marketed worldwide except in the United States.

Laboratory/Developer

Binax, Inc.
USAMMDA

Dengue Fever Vaccine (Dengue Tetravalent Vaccine [DTV])

Mission

The DTV will prevent mission-degrading, potentially lethal occurrences of dengue fever and dengue hemorrhagic fever (DHF) in service members who are deployed to dengue-threat tropical and subtropical regions of the world, increasing the survivability and sustainability of U.S. forces.

Description

Dengue virus infection causes an acute, incapacitating illness characterized by severe head, muscle, joint, and eye pain, with fever lasting from 4 to 7 days. Subsequent infection with a different dengue virus can occur and may result in the more severe hemorrhagic form of the disease. Dengue fever is a leading cause of hospital admissions in units operating in the tropics. There are currently no licensed vaccines or drugs to prevent dengue fever or the often-fatal DHF.

The product to be developed is a live-attenuated virus vaccine containing all four monovalent dengue virus serotypes, produced from purified, inactivated organisms. The DTV must simultaneously provide long-term protection against all four known dengue viruses because cross-immunity among the four dengue viruses lasts only a few weeks. Co-infection with more than one dengue virus type can lead to the often-fatal DHF.

Laboratory/Developer

GlaxoSmithKline (GSK)
USAMMDA

Diarrheal Disease Vaccines

- **Campylobacter Vaccine**
- **Enterotoxigenic *Escherichia coli* (ETEC) Vaccine**
- **Shigella Vaccine**

Mission

Vaccines against Campylobacter, enterotoxigenic *E. coli,* and Shigella will enhance the sustainability of U.S. forces in regions of the world where these diarrheal illnesses and dysentery are endemic.

Description

Diarrheal diseases affect up to 50% of U.S. service members early and continuously in deployments to disease-endemic areas. Diarrhea is debilitating and can be life threatening, causing severe dehydration and shock from the loss of fluids. Diarrheal illness from ETEC alone can limit the mobility of U.S. forces and decrease their efficiency and functional capability significantly. Currently, there are no totally effective preventive medicine measures or vaccines to protect troops against these threats.

Campylobacter Vaccine. An oral, whole-cell killed vaccine has been tested on humans. A second generation, potentially improved recombinant protein-based vaccine is about to enter clinical testing. Additional protein antigens may be required and are being identified and tested in basic science and preclinical studies.

ETEC Vaccine. The current research program is focused on developing a purified protein subunit vaccine against ETEC. The target antigens in this vaccine strategy are the major ETEC colonization factor antigens and nontoxic derivatives of heat-labile enterotoxin.

Shigella Vaccine. Vaccines against *Shigella flexneri, S. sonnei,* and *S. dysenteriae* are currently under development. Two promising vaccine approaches are being evaluated: (1) Invaplex extracts of Shigella bacteria that induce immunity when sprayed into the nose and (2) live Shigella vaccines that are genetically modified and safely induce immunity following ingestion.

Laboratory/Developer

NMRC
WRAIR

Product Status: PROMISING ◆ **FUTURE** ◆ COMPLETED

Subcategory: ***Prevention***

Hepatitis E Virus (HEV) Vaccine

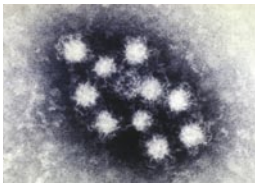
Mission

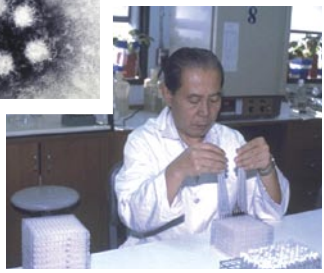
The HEV Vaccine will enhance the survivability and sustainability of U.S. forces in regions of the world where HEV is endemic. Nonimmune service members deployed to endemic regions are at risk.

Description

Hepatitis E is most often transmitted through the fecal-oral route; drinking fecally contaminated water is the most common mode of transmission. The illness often occurs 2 to 6 weeks after infection and results in protracted convalescence lasting several weeks to months. In some cases, infection results in severe rapidly progressing disease that ends in death due to liver failure. The case-fatality rate is approximately 2% in men and nonpregnant women and up to 20% in pregnant women during the third trimester of pregnancy. The highest incidence of HEV infection occurs in young adults (of military age) making approximately 97% of American adults susceptible to HEV infection.

The HEV vaccine is a recombinant vaccine that consists of a purified polypeptide produced in insect cells infected with recombinant baculoviruses and formulated with an aluminum salt adjuvant.



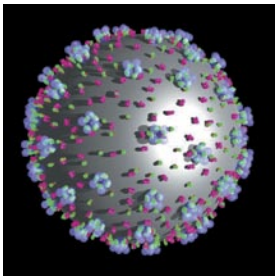


Laboratory/ Developer

GSK
USAMMDA

Human Immunodeficiency Virus (HIV)

- ♦ HIV Vaccine
- ♦ HIV Research Program



Mission

The HIV Vaccine will enhance the survivability and sustainability of U.S. forces worldwide. Furthermore, the HIV Vaccine will promote political, social, and economic stability, thereby deterring conflict and the need for U.S. intervention in areas where HIV has caused significant morbidity and mortality.

Description

HIV poses a threat to U.S. military forces and is a national and global security issue. The magnitude of this disease is so great that it could destabilize foreign governments and slow economic growth worldwide. A few new cases of HIV occur annually among U.S. Army personnel, and it is estimated that 30% of these HIV infections are acquired during overseas deployments, predominantly from the less developed countries of sub-Saharan Africa, Asia, and South America. According to the Central Intelligence Agency, HIV/AIDS will probably cause more deaths than any other single infectious disease and account for at least half of infectious disease deaths worldwide by 2020.

HIV Vaccine. The HIV Vaccine consists of a prime with a recombinant canarypox virus expressing the products of three HIV-1 genes and a boost with a synthetic surface protein of the virus. The prime-boost vaccine approach is being used to induce both cellular and humoral immunity to HIV.

HIV Research Program. The HIV vaccine research and development program is mandated to develop a safe and effective HIV-1 vaccine against all HIV-1 subtypes (A, B, C, D, and E). The plan is to link the global vaccine mandate to regional overseas laboratories.

Laboratory/Developer

Army OCONUS laboratories
NIAID (prime-boost)
Sanofi-aventis (prime-boost)
USAMMDA (prime-boost)
VaxGen (prime-boost)
WRAIR (tech base R&D)

Product Status: PROMISING ◆ **FUTURE** ◆ COMPLETED

Subcategory: ***Prevention***

Improved Insect Repellent

Mission

This new repellent will offer the greatest tactical flexibility of any arthropod-borne disease prevention strategy.

Description

Repellents can be applied effectively to prevent any arthropod-borne disease, even if surveillance has not identified the pathogen. They are often the only means of protection from arthropod-borne diseases in combat environments when vector control measures are not possible, when no vaccines exist for diseases in the deployment area of operations, or when the speed of military developments prevents the use of chemoprophylaxis or vaccines.

The current military insect repellent is ineffective against some disease vectors and has a very low Soldier acceptance rate. Because no commercially available repellents meet Army requirements, new effective repellent compounds and leading-edge formulation technologies are being explored and prioritized. A new military insect repellent that is completely acceptable to the user and maintains effectiveness under combat conditions is desired.

Laboratory/Developer

U.S. Department of Agriculture
WRAIR

Malaria Vaccines

- **Recombinant Vaccine (RTS,S + Adjuvant)**
- ***P. falciparum* RTS,S + MSP-1**
- **Malaria DNA Vaccine and Prime Boost Approaches**
- **Adenovirus Vaccine against *P. falciparum***

Mission

A safe, well-tolerated malaria vaccine will provide protection against disease and prevent blood-stage infection, enhancing the survivability and sustainability of U.S. forces worldwide where malaria is endemic.

Description

P. falciparum is the most life threatening type of malaria, causing massive destruction of the body's red blood cells. Currently, there are no licensed vaccines and the malaria parasite continues to develop resistance to new drugs used for treatment and/or prevention. Initially, *P. falciparum* malaria vaccines are being developed, but a combined vaccine to protect against all types of malaria is the long-term goal.

Recombinant Vaccine (RTS,S + Adjuvant). One *P. falciparum* malaria vaccine candidate consists of the RTS,S recombinant malaria protein antigen combined with a proprietary adjuvant from GSK.

***P. falciparum* RTS,S + MSP-1.** This vaccine consists of the RTS,S recombinant protein antigen combined with an additional malaria antigen component.

Malaria DNA Vaccine and Prime Boost Approaches. Study investigators have demonstrated substantial protection using a combination of malaria DNA and pox virus. Another approach has been to combine RTS,S with adenovirus 35 (an uncommon adenovirus serotype against which little natural immunity exists).

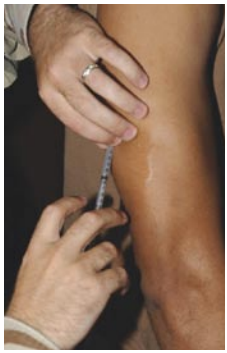
Adenovirus Vaccine against *P. falciparum*. A multi-component recombinant cSLAM (cellular Signalling Leukocyte Activating Molecule) adenovirus vaccine containing five promising antigens of *P. falciparum* will be used as a boost in combination with a DNA priming vaccine.

Laboratory/Developer

Army and Navy OCONUS laboratories (tech base R&D)
CDMRP (Adenovirus)
GSK (RTS,S + Adjuvant)
NMRC (tech base R&D, Adenovirus)
USAMMDA (RTS,S + Adjuvant)
WRAIR

Product Status: PROMISING ◆ **FUTURE** ◆ COMPLETED

Subcategory: ***Prevention***



Meningococcal Type B Vaccine

Mission

Meningococcal meningitis is fortunately uncommon but causes a devastating illness, and a single case of meningitis can result in major disruptions of military operations and training because of the need for preventive and assessment measures. Five types of meningococcus (A, C, Y, W-135, and B) cause 80% of meningococcal meningitis. DoD researchers have contributed to development of a licensed tetravalent vaccine protecting against A, C, Y, and W-135. Development of a vaccine protective against type B meningococcus is under way; the ultimate goal is a pentavalent vaccine. Candidate monovalent meningococcal Group B vaccines have been shown to provide protection against strains of the same subtype in 50%-80% of vaccinated subjects, and work is continuing to develop a polyvalent vaccine to provide wider protection against Group B meningococcus.

Description

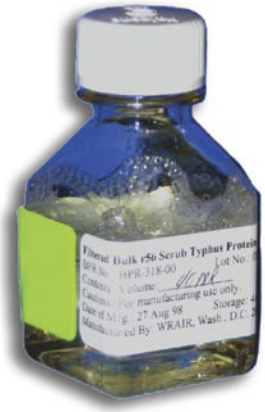
Meningococcal meningitis is an acute bacterial disease that occurs commonly in young adults, in males more than females, and particularly in newly aggregated adults under crowded living conditions such as barracks. It is a threat to Soldiers in basic and advanced training, especially during major military moblizations. The disease is prevalent in sub-Saharan Africa and South America and is potentially life threatening or permanently debilitating. New, virulent Group B clones have caused prolonged epidemics in at least 5 countries over the past 20 years.

Monovalent Group B vaccines are effective in protecting against disease only if they are made from the specific strain of the organism causing the outbreak. A polyvalent vaccine derived from three different strains is being developed to provide broad coverage against Group B organisms. Both intranasal and intramuscular routes of administration are being examined.

Laboratory/Developer

WRAIR

Subcategory: Prevention



Scrub Typhus Vaccine

Mission

Scrub Typhus Vaccine will prevent mission-degrading, potentially lethal occurrences of scrub typhus in service members who are deployed to highly endemic areas, increasing the survivability and sustainability of U.S. forces.

Description

Scrub typhus, caused by *Orientia tsutsugamushi,* was problematic to U.S. forces during World War II and the Vietnam War and still poses a threat for deployments to some areas of Asia and the Asia-Australia-Pacific Islands. Recent concern about antimicrobial-resistant strains of scrub typhus has prompted efforts to create a vaccine to prevent *O. tsutsugamushi* infection. Current efforts are focused on using recombinant protein vaccine technology to produce a stable, standardized vaccine that will protect the warfighter from multiple strains of scrub typhus.

Laboratory/ Developer

NMRC

Product Status: PROMISING ◆ **FUTURE** ◆ COMPLETED

Subcategory: ***Prevention***

Vaccines to Prevent Hemorrhagic Fever with Renal Syndrome (HFRS)

Mission

The vaccine products are designed to provide protection against all four Hantaviruses and enhance the sustainability of U.S. forces in regions of the world where Hantaviruses are endemic.

Description

HFRS is a problem throughout Asia and Europe that has caused life-threatening illness in thousands of Soldiers. The virus is usually transmitted to humans via exposure to aerosols created when infected rodents' urine, feces, or saliva is released onto environmental surfaces. After an incubation period of approximately 1-4 weeks, the patient may develop fever, kidney dysfunction, alterations of blood pressure, accumulation of fluid in the lungs, and blood-clotting problems.

Two vaccine approaches are under evaluation: (1) a DNA vaccine expressing Hantaan virus M segment (expected to protect humans from HFRS caused by Hantaan virus, Seoul virus, and Dobrava virus but not Puumala virus); and (2) a Puumala virus DNA vaccine (expected to protect humans from HFRS caused by Puumala virus).

Laboratory/Developer

NIAID
USAMMDA
U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID)
WRAIR

Antimalarial Drugs

- ♦ Artesunate
- ♦ Tafenoquine

Mission

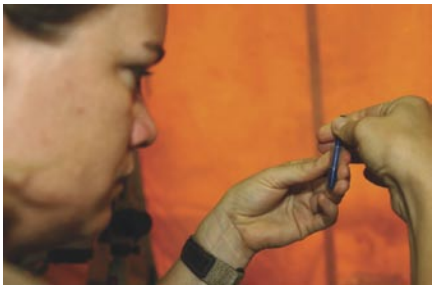
New drug prophylactics and therapies used for the treatment of malaria will increase the survivability and sustainability of U.S. forces deployed in highly endemic areas.

Description

The malaria parasite, transmitted by infected mosquitoes, is developing resistance to current antimalarial prophylactic drugs, and resistance is now widespread in Africa and Asia. Symptoms can be fever and flu-like including shaking, chills, headache, muscle aches, and tiredness. If not treated promptly, one type of malaria, *P. falciparum*, may cause kidney failure, seizures, mental confusion, coma, and death. Two other types, *P. vivax* and *P. ovale*, concentrate in the liver cells, eventually emerging into the blood and causing disease. The most dangerous species, *P. falciparum*, moves out of the liver and into the blood in just a few days.

Artesunate. Additional drugs to safely treat life-threatening malaria are urgently needed, and artesunate is a promising candidate for this role.

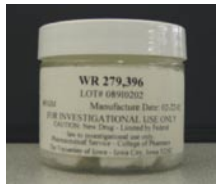
Tafenoquine. Studies suggest that tafenoquine suppresses both the liver and blood stages of the malaria parasite and their effects and may also block transmission from already infected individuals.



Laboratory/Developer

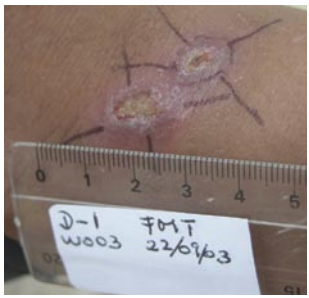
GSK (Tafenoquine)
USAMMDA (Tafenoquine)
WRAIR (Artesunate)

Topical Antileishmanial Drugs (Paromomycin)



Mission

Topical antileishmanial ointment will enhance the survivability and sustainability of U.S. forces in endemic regions by allowing for local early lesion treatment. It will also prevent morale and personnel problems in the unit due to the loss of affected personnel for treatment that requires evacuation out of the theater of operations for daily intravenous injections with highly toxic investigational pentavalent antimony drugs.



Description

Cutaneous leishmaniasis is a potentially disfiguring and serious parasitic disease. Leishmaniasis is one of several names for various tropical diseases that are caused by protozoa of the genus *Leishmania*. The parasites are transmitted by sandflies in tropical and subtropical zones. The manifestations of this disease may be visceral, mucocutaneous, or cutaneous. This illness is predominantly found in tropical and subtropical areas in the Middle East, southwest Asia, the Mediterranean coast, sub-Saharan Africa, Mexico, and Central and South America. In addition, there have been confirmed reports of canine leishmaniasis cases in 21 states across the United States. Current therapy for cutaneous leishmaniasis requires intravenous administration of toxic, metal-based drugs (antimonials) that have undesirable side effects and toxicities including vomiting, diarrhea, pancreatitis, elevated liver enzymes, and at higher doses, pulmonary edema.

The topical antileishmanial drug paromomycin (Topical Paromomycin) (a cream made from two aminoglycoside antibiotics, paromomycin [15%] and gentamicin [0.5%], formulated in an aquaphilic base) will permit early treatment if disease is limited to a few lesions.

Laboratory/Developer

USAMMDA

Subcategory: *Diagnostics*

Dengue Diagnostic Systems

Mission

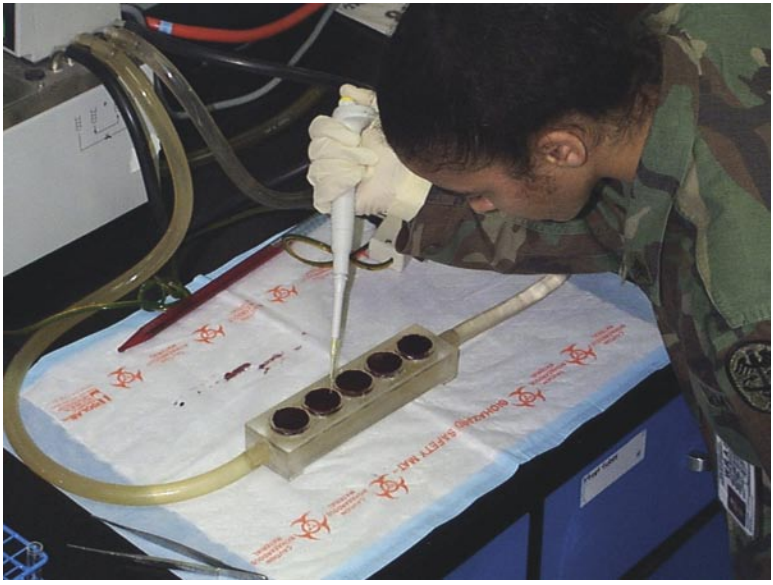
A Dengue Diagnostic System will allow for real-time diagnostics development and validation in an attempt to limit transmission of the disease.

Description

WRAIR and other collaborators are using real-time reverse transcriptase polymerase chain reaction (RT-PCR) to evaluate dengue viral loads from natural dengue infections and systematically infected samples from human volunteers, laboratory animals, and tissue cultures. Collaborative efforts involve anti-dengue drug screening, dengue vaccine development, and dengue epidemiological surveys.

Laboratory/Developer

WRAIR



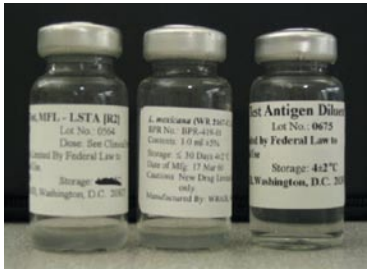
Leishmania Skin Test

Mission

The Leishmania Skin Test will improve sustainability of U.S. forces in tropical and temperate regions of the world.

Description

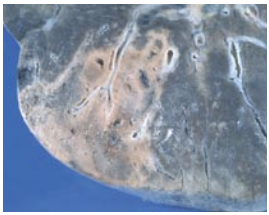
Cutaneous leishmaniasis is a potentially disfiguring and serious parasitic disease. Leishmaniasis is one of several names for various tropical diseases that are caused by protozoa of the genus *Leishmania*. The parasites are transmitted through the bite of an infected sandfly usually found in tropical and subtropical zones. More than a million new cases of human leishmaniasis are reported annually. The manifestations of this disease may be visceral, mucocutaneous, or cutaneous. The cutaneous form of the disease can sometimes cause highly mutilating lesions on the skin and face, common areas for sandflies to bite. Visceral leishmaniasis is the most severe form and attacks the spleen, liver, and lymph nodes. Left untreated, this form of the disease is usually fatal within several years. This illness is predominantly found in tropical and subtropical areas in the Middle East, southwest Asia, the Mediterranean coast, sub-Saharan Africa, Mexico, and Central and South America.



The Leishmania Skin Test is performed by injecting a small amount of purified leishmania proteins under the skin and measuring local skin reaction up to 72 hours later. A small bump at the skin test site is a positive indication of parasite exposure.

Laboratory/Developer

USAMMDA



Adenovirus Vaccine
(Adenovirus Vaccine Live Oral Type 4 and Live Oral Type 7)

- A live viral vaccine tablet for oral administration to prevent adenovirus infection and associated diseases such as acute respiratory disease and pneumonia.
- Reduced incidence and epidemic spread of respiratory disease in military and civilian populations. Production ceased in 1995 due to costly facility upgrade requirements.
- Completed date: 1980.

Aerosol Generator, Ultra-Low Volume, Electric (AGULVE)

- A lightweight unit for pesticide fogging operations composed of a spray head and pump that is powered from a vehicle's electric power supply.
- Improves sustainability of U.S. forces in disease-carrying insect-infested regions of the world.
- Completed date: 1993.

Camouflaged Bednet Shelter

- A self-supporting, low-profile bednet shelter impregnated with a quick-acting insecticide for knock-down effect and containing an integral collapsible support structure.
- Provides improved protection against biting insects and improves Soldier survivability and sustainability in regions of the world with insect-transmitted diseases.
- Completed date: 2004.

Product Status: PROMISING ◆ FUTURE ◆ **COMPLETED**

Subcategory: ***Prevention***

Doxycycline (Vibramycin)

- A drug originally developed as an antibacterial agent with useful antimalarial properties against tissue malaria parasite forms.
- Is effective against chloroquinine-resistant malaria parasite strains with less side effects than mefloquine but requires daily administration, is slow acting, and has side effects that impact daily compliance. Cannot be given to pregnant women or children.
- Completed date: 1992 (new indication).

Electronic Surveillance System for the Early Notification of Community Based Epidemics (ESSENCE)

- A prototype system for the early detection of infectious disease outbreaks at military treatment facilities. Data from patient symptoms are instantaneously recorded at a patient's visit and uploaded into ESSENCE that also contains Ambulatory Data System diagnoses from 104 primary care and emergency clinics within a 50-mile radius of Washington, DC. Diagnostic codes are grouped into "syndromic clusters" consistent with emerging infections including bioterrorism.
- Once an outbreak is suspected, the system dispatches an epidemic control team that may include epidemiologists, statisticians, and laboratory personnel.
- Completed date: Ongoing.

Global Emerging Infections System (GEIS)

- In the United States, GEIS units are located in California, Texas, Virginia, and Washington, DC. Overseas they are located in Peru, Egypt, Thailand, Indonesia, and Kenya. Together these assets represent a global health care system, connected by a worldwide, state-of-the-art communication system using a relatively standardized information technology infrastructure for supporting medical surveillance activities.
- Facilitates early recognition and control of new disease problems that threaten national security.
- Completed date: Ongoing.

Hepatitis A Vaccine (HAVRIX)

- An inactivated viral vaccine for the prevention of Hepatitis A infection.
- Prevents epidemics during deployments to endemic regions and areas with suboptimal sanitation, water, and waste systems, as well as at military posts. Replaced use of immune serum globulin that required repeated injections, was not readily available, and was impractical to distribute during large deployments.
- Completed date: 1995.

Product Status: PROMISING ◆ FUTURE ◆ **COMPLETED**

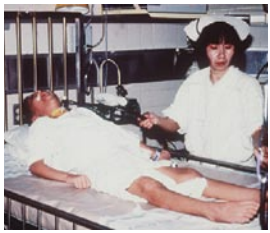
Subcategory: ***Prevention***

Hepatitis B Vaccine (HBV) (Hepatavax B)

- HBV previously produced by using plasma from infected individuals is now produced by recombinant methods in yeast cells and prevents hepatitis B infection that is transmitted by blood and body fluid exposure.
- The Army contributed to the epidemiology and HBV subtyping efforts only.
- Completed date: 1981.

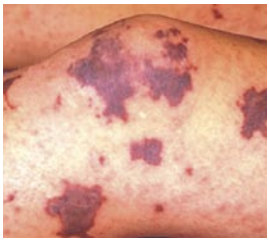
Influenza Virus Vaccine

- A vaccine for prevention of influenza infection composed of inactivated whole-virus.
- Prevents influenza infection and its rapid epidemic spread in close quarters and contact that otherwise can significantly impact military readiness and civilian productivity and can potentially lead to death in the very young and old.
- Completed date: 1945.



Japanese Encephalitis Vaccine (JE-Vax)

- A formalin-inactivated whole-virus vaccine against the Japanese encephalitis virus, which is transmitted by mosquitoes.
- Prevents JE infection, for which there is no treatment, that can result in fever and mild illness to brain inflammation, neurological sequelae, and sometimes death. Outbreaks occur in Asia, the Pacific Islands, northern Australia, and Russia.
- Completed date: 1992.

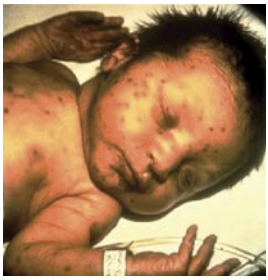


Meningococcal Vaccine (MENOMUNE)

- A tetravalent vaccine, composed of purified components from the polysaccharide coating (A, C, Y, and W-135), against the *Neisseria meningitidis* bacteria that is transmitted by respiratory droplets under close person-to-person contact.
- Will prevent meningococcal infections that if invasive can lead to meningitis and sepsis with a 10%-30% fatality rate. Reduces the risk of meningococcal disease outbreaks among military recruits and Soldiers.
- Completed date: 1981.

Pesticide Dispersal Unit, Multicapability, Helicopter Slung

- A multimode (solid/liquid) pesticide sprayer powered by a hydraulic motor and attached beneath the helicopter via a sling with a cargo hook and controlled within the helicopter.
- Will improve sustainability of U.S. forces in disease-carrying, insect-infested regions of the world.
- Used successfully during Hurricane Andrew.
- Completed date: 1993.



Rubella Vaccine
(Meruvax, now Meruvax II)

- A live-attenuated viral vaccine for prevention of rubella, or German measles, which spreads person-to-person via respiratory droplets, causes fever and rash, and can lead to serious fetal malformations in pregnant women.
- Introduction of the vaccine in 1969 to the United States resulted in a drop from 47,745 cases (for the 3 years prior) to 345 cases in 1998.
- Completed date: 1969.

Oral Live Typhoid Vaccine
(Vivotif Berna)

- An attenuated live oral vaccine used to protect against *Salmonella typhi* bacterium infection that is caused by the ingestion of contaminated food or contact with contaminated feces and can be spread by a healthy carrier of the bacterium.
- Prevents typhoid fever, an acute generalized illness with fever, headache, abdominal pain, mild rash, and bowel movement and mental changes. In combination with hygiene control, reduces the likelihood of epidemic spread of the disease, particularly in areas that lack clean water and effective sanitation systems.
- Completed date: 1989.

Chloroquine (Aralen)

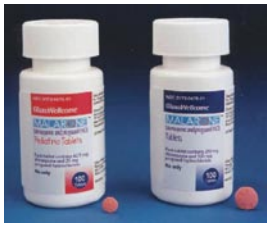
- An antimalarial drug for both the treatment and prevention of *P. falciparum* and *P. vivax* malaria.
- Rapidly controlled clinical symptoms of susceptible malarias; useful in prevention taken once a week. Emergence of chloroquine-resistant malaria parasites has limited the use of this drug.
- Completed date: 1949.

Primaquine

- An antimalarial drug for the treatment and prevention of relapsing malaria following *P. vivax* and *P. ovale* infections; attacks the liver stage of the malaria parasites.
- Reduces recurrent malaria caused by latent forms of the malaria parasites present in the liver after cessation of a prior preventative such as chloroquine. Also prevents malaria infection.
- Completed date: 1952.

Sulfadoxine-Pyrimethamine (Fansidar)

- A drug for the treatment and prevention of malaria, particularly chloroquine-primaquine resistant, that acts by blocking folic acid to prevent replication of the malaria parasites.
- Occurrence of infrequent, but serious, adverse allergic reactions limits its use except in countries where chloroquine-resistant malaria is widespread and other drugs are not available.
- Completed date: 1983.



Atovaquone-Proguanil (Malarone)

- A combination of two existing drugs for treatment of *P. falciparum* malaria that acts on the malaria parasite by inhibiting essential synthesis pathways.
- The combination of drugs has an enhanced effectiveness over the single-drug treatments for malaria and has reduced side effects compared to other antimalarial drugs.
- Completed date: 2000.

Chloroquine-Primaquine

- A combination of two antimalarial drugs for treatment of *P. vivax* infection. See also Chloroquine and Primaquine.
- Combining the two drugs into a single treatment yields improved compliance with the two-drug treatment for relapsing malaria.
- Completed date: 1969.

Halofantrine (Halfan)

- Antimalarial drug for the treatment of chloroquine-resistant *P. falciparum* malaria.
- No longer licensed in the United States due to potential for cardiac toxicity.
- Completed date: 1992.

Quinidine/Quinine

- A drug for treating chloroquine-resistant *P. falciparum* malaria, a parasitic disease transmitted by mosquitoes.
- Inadequate personal protection (e.g., bed nets and repellents) and preventive drug regimens necessitate treatment measures for malaria infections that can lead to serious or fatal complications such as brain infection. Military physicians demonstrated the efficacy of large doses to treat remittent fevers that led to improved results with quinine around the world.
- Completed date: 1991 (labeling revision).

Military Infectious Diseases

Combat Casualty Care

Military Operational Medicine

Medical Chemical and Biological Defense

Telemedicine, Logistics, IM/IT, and Facilities

Overview

Caring for combat casualties is constrained by logistics, manpower, and the hostile operational environment.

Eighty-six percent of all battlefield deaths occur within the first 30 minutes after wounding, making the ability to rapidly locate, diagnose, and treat injuries vital to reversing the historical outcomes of battlefield injuries. The Combat Casualty Care Research Program's goals are to reduce the killed-in-action rate of American troops by 25%, reduce the morbidity of combat injuries, and reduce the medical footprint on the battlefield.

Several factors complicate providing combat casualty care. Military casualties may wait for hours before definitive health care can be provided. Initial treatment and subsequent evacuation occur in austere environments characterized by limited supplies and limited diagnostic and life-support equipment. Further, providing acute and critical care is labor intensive and must frequently be provided by non-physician medical personnel. The primary challenge for combat casualty care research is overcoming these limitations by providing biologics, pharmaceuticals, and devices that enhance the capability of first responders to effectively treat casualties as close to the location and time of injury as possible.

Minimizing Blood Loss and Optimizing Fluid Resuscitation

Since mid-World War II, nearly 50% of combat deaths have been due to exsanguinating hemorrhage. Of those, about half could have been saved if timely, appropriate care had been available. Enhanced means are sought to limit actual and functional volume losses and to limit the immediate, short-, and long-term consequences of such hemorrhages. This science and technology (S&T) effort focuses on the development of products to enhance capabilities for control of hemorrhage, stabilization, resuscitation from hemorrhage, and the development of noninvasive sensors to determine tissue viability and perfusion.

Examples of specific products or efforts would include chemically powered fluid infusion or warming devices, plasma substitutes for burn and shock, blood and platelet preservative, local hemostatic agents, and treatments to enhance oxygen delivery and perfusion of tissue, blood products (and artificial substitutes), resuscitation fluids, and equipment and procedures for fluid resuscitation of hemorrhaging individuals. Also of interest are investigations into improved preservation, storage transportability, and processing of red blood cells, platelets, and plasma; fieldable rapid test kits for blood-borne pathogens and blood typing; fundamental investigations of vascular and tissue responses to fluid resuscitation; and the development of simple fluid warming and administration devices that:

- Prevent cell death or organ failure,
- Reduce or eliminate ischemia and reperfusion injury,
- Prevent secondary brain or spinal cord injury,
- Prevent immunosuppression and sepsis,
- Reduce the demand for metabolic substrates including oxygen, and
- Prevent bacterial translocation.

Treatments for Battle and Non-Battle Injuries

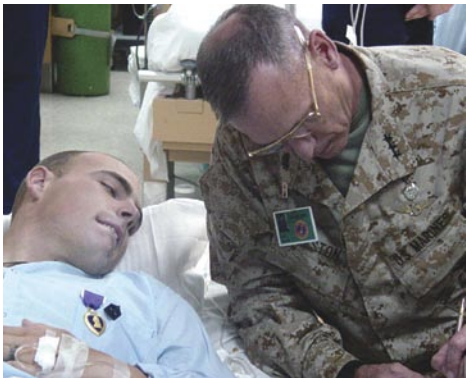
This S&T effort includes:

- Identification and transition to development drugs, or implantable devices, for enhanced healing of soft tissue and bone defects caused by military ballistic injury;
- Development of noninvasive sensors to determine tissue viability and perfusion;
- Identification and testing of techniques, drugs, and treatments to enhance vascular repair;
- Techniques and assessments for commercial materiel developments applicable to surgical management of primary ballistics and thermal burn injuries; and
- Techniques for management of primary blast, crush, and chemical burn injuries.

Examples of specific products or efforts that might be addressed include materiel for the pharmacological or surgical management of high-velocity ballistics, fragment wounds, and blast injuries. Materiel of interest also includes agents that promote neuronal regeneration, bone repair/regeneration, and vascular healing and regeneration; treatment of chemical burns; equipment and procedures for emergency airway management; and mechanical ventilation of severely injured casualties.

Meeting Program Goals

Battlefield conditions impose severe constraints on available manpower, equipment, and medical supplies for casualty care. A premium is placed on medical interventions that can be used on the battlefield or as close to it as possible, before or during medical evacuation, preferably by medical corpsmen. Medical materiel must be easily transportable (i.e., small, lightweight, and durable); devices must be easy to use, low maintenance, with self-contained power sources as necessary; and drugs and biologics, ideally, should not require refrigeration or other special handling.



More specifically, the program's efforts address:

- Products and methods that reduce the number of battlefield deaths due to hemorrhage;
- Advanced, noninvasive physiologic sensors for detecting penetrating or blunt trauma wounding events and remote triage;
- Techniques and technologies that improve the acquisition and availability of blood products and reduce the medical and logistical requirements to care for battlefield casualties;
- Prevention and treatment of dental disease;
- Surgical techniques, equipment, and implants to address extremity or musculoskeletal injuries sustained on the modern battlefield;
- Neuroprotective treatment strategies that significantly improve the prognosis for the Soldier's functional recovery from brain and spinal cord injuries;
- Diagnostics to help the medic on the battlefield determine which casualties require immediate resuscitation;
- The best fluids and strategies for resuscitation to improve survival when evacuation is delayed and resources are limited; and
- Technology to render self and buddy aid.

The resulting Combat Casualty Care products listed in this section are divided into the following subcategories:

- Hemorrhage Control/Resuscitation Strategies,
- Hard and Soft Tissue Injury,
- Neuroprotective Treatment Strategies,
- Trauma Management Systems, and
- Dental.

Advanced Resuscitation Fluid

Mission

The Advanced Resuscitation Fluid for small-volume fluid resuscitation and hypotension will assist the combat medic, physician's assistant, and surgeon in reducing mortality and morbidity associated with trauma and blood loss.

Description

The Advanced Resuscitation Fluid will help to maintain critical levels of blood pressure and tissue perfusion to preserve organ integrity and function. The fluid is designed for small-volume resuscitation for trauma and blood loss with delayed evacuation for up to 72 hours.

The capabilities of this product will support the continuing effort to extend the "Golden Hour" for far-forward treatment to improve survival and minimize morbidity after life-threatening injuries. Specifically, the product will counter the vascular injury and immune system activation caused by decreased perfusion and oxygen radical generation during tissue re-oxygenation. The product will also not interfere with the ability of the blood to coagulate or form clots.

Laboratory/Developer

Life Sciences Research Office Independent Panel on Resuscitation Fluid for Use in Combat

Walter Reed Army Institute of Research (WRAIR)

Cartledge Infuser (CI)

Mission

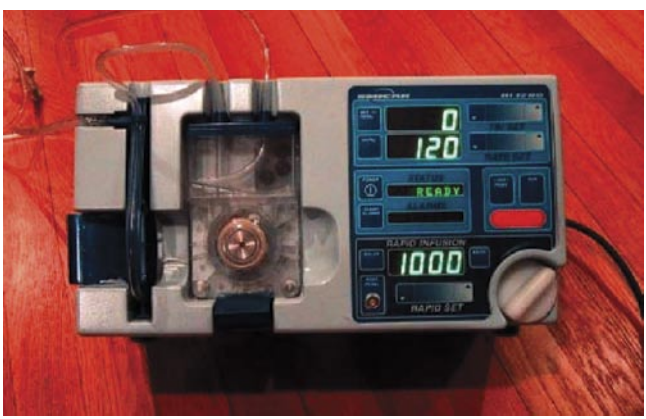
The CI is intended to allow a physician to normalize a patient's hemodynamic status. In any military conflict or civilian disaster, it is an unfortunate fact that there will be casualties requiring rapid transfusion of blood and other lifesaving fluids. The CI is able to warm and rapidly transfuse these fluids.

Description

The CI is a variable rate infusion pump that allows a physician to replace blood volume at volume rates ranging from 20 mL per hour through 1,200 mL per minute. A blood-warming system is incorporated into the design and provides optimal blood warming at any flow rate. The CI operates on standard alternating current power and is capable of battery operation for up to 1 hour. It weighs approximately 18 pounds and is 14 inches wide, 8 inches high, and 8 inches deep.

Laboratory/Developer

U.S. Army Medical Materiel Development Activity (USAMMDA)



Ceramic Oxygen Generator (COG)

Mission

The generation of oxygen where it is needed reduces the logistical requirements for the transport of oxygen cylinders to and within the operational theater.

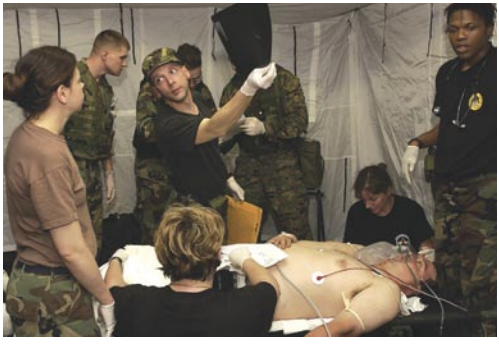
Description

The COG uses a metal reinforced composite, thin-film ceramic membrane to generate oxygen. Producing 1 liter of oxygen requires 30 watts of electricity. The device will be battery powered and weigh only 10 pounds.

Existing oxygen production technology uses techniques such as pressure swing adsorption or cryogenics to separate oxygen from air. The COG uses no major moving parts; instead it uses a thin hot ceramic membrane that has a voltage applied to it. The applied voltage drives atmospheric oxygen and only oxygen through the membrane to a collection chamber. The mechanical simplicity and high efficiency make this a promising technology.

Laboratory/Developer

IGR Enterprises, Inc.
USAMMDA



Hemoglobin-Based Oxygen Carrier (HBOC)

Mission

A resuscitation fluid with oxygen-carrying capability will be used in casualties who have suffered life-threatening hemorrhage on the battlefield and who require red blood cells that are not available.

Description

The HBOC is a non-type-specific solution of hemoglobin polymer derived from either human or animal blood. Hemoglobin is the oxygen-carrying component of red blood cells. Depending upon the manufacturer, the HBOC is stable for up to 1 year at room temperature and for 2 years at 4°C.

This product provides a more temperature-stable alternative to red blood cells that eliminates the need for blood typing and can be used in a far-forward environment for casualty resuscitation.

Laboratory/Developer

Biopure Corporation
Northfield Laboratories
USAMMDA

Hemostatic Dressing

Mission

Medics, combat lifesavers, and other medical personnel will use the Hemostatic Dressing on the battlefield to aid in the control of severe hemorrhage in injured Soldiers.

Description

The Hemostatic Dressing is composed of freeze-dried human thrombin and fibrinogen layered on an absorbable Dexon backing in a sandwich configuration. When used with direct pressure, the dressing will stop severe arterial, venous, or mixed bleeding in 2 to 4 minutes. The dressing is intended for treatment of either external or internal bleeding.

The Hemostatic Dressing is a method of controlling hemorrhage in the far-forward environment. Special Operations Forces medical personnel used the Hemostatic Dressing in Operation Iraqi Freedom under a battlefield Investigational New Drug clinical protocol.

Laboratory/Developer

USAMMDA
U.S. Army Institute of Surgical Research (USAISR)

Intranasal Ketamine (PMI-150)

Mission

The U.S. military has identified a need for improved acute pain relief that allows the warfighter to remain cognitively functional. Effective analgesia on the battlefield lessens adverse pathophysiologic responses to pain, aids evacuation, and improves morale.

Description

Current military doctrine endorses morphine as the first-line agent for battlefield casualty analgesia. Morphine, administered intravenously (IV) (5 mg) or intramuscularly (8 mg), provides reliable analgesia. However, morphine at standard doses impairs cognitive function, often to the point of incapacitation, and can cause hypotension and respiratory depression to the point of being life threatening in the casualty. Re-dosing for refractory pain increases the likelihood of these complications. Soldiers administered morphine are effectively lost to the unit and require close observation by medics or other unit members for the duration. Casualties, especially those given morphine, can quickly overwhelm the combat health support available to a commander, potentially putting the mission in jeopardy.

Ketamine has been identified as a potential battlefield analgesic to replace morphine. Ketamine is an anesthetic commonly used today for surgical procedures in both humans and animals. At sub-anesthetic low doses it produces significant analgesia mainly through selective, non-competitive blockade of the N-methyl-D-aspartate receptor. It does so without the cardiopulmonary depressive effects of morphine and other anesthetics and centrally acting analgesics. This would be especially advantageous for the warfighter on the personnel-autonomous and geographically dispersed battlefield of the future.

Laboratory/Developer

USAISR
U.S. Army Aeromedical Research Laboratory (USAARL)
U.S. Army Research Institute of Environmental Medicine (USARIEM)
WRAIR

Nexus IV Delivery System (NIVDS)

Mission

This delivery system will offer a precise, low-cost alternative to electronic infusion pumps and their consumables as well as significant supply and inventory cost savings.

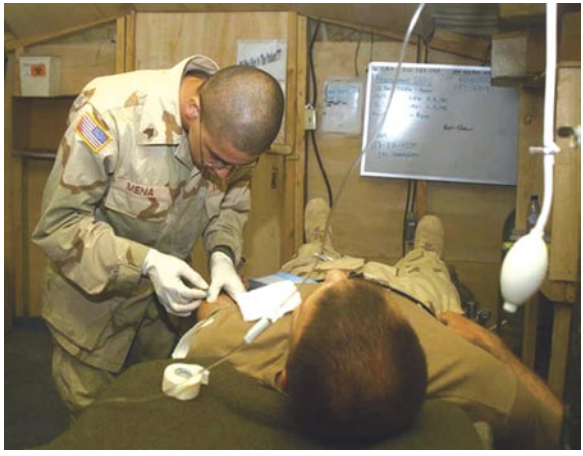
Description

The NIVDS is an infusion system that accurately dispenses precise amounts of low viscosity fluids. Once set, the infusion rate will be maintained regardless of pressure differentials or patient changes. The NIVDS incorporates a differential pressure control mechanism, containing no electronics, which senses changes in fluid level and pressure and compensates to maintain a constant delivery rate. The NIVDS is expected to cost only a few dollars.

The NIVDS reduces the need for reliance on costly electronic IV systems and their consumables. The expectation is that 35% of the more costly systems can be replaced with the NIVDS.

Laboratory/Developer

USAMMDA



Rotary Valve Pressure Swing Oxygen Generator (RVPSOG)

Mission

This smaller, more efficient product will reduce the logistical burden of the oxygen generator for forward-deployed medical assets for use in single-patient care and transport.

Description

Existing pressure swing adsorption oxygen generator technology is being miniaturized into a portable device. Miniaturization requires the development of a small but reliable compressor. A rotary valve driven directly by a small motor will eliminate complex valve and control systems used in conventional oxygen generators.

The logistical burden of resupply and refill of oxygen cylinders will be eliminated. The generator replaces the standard "D" cylinder for patient care and transport and yields increased efficiency and reduced size and weight.

Laboratory/Developer

USAMMDA

Technique for Rescuing Blast Casualties

Mission

The technique will cause a casualty who has stopped breathing due to a blast insult to start breathing again.

Description

Research indicates that exposure to a blast insult can cause an animal to stop breathing (become apneic), sometimes long enough that it causes the animal to die. The apneic animals have been successfully stimulated to reinitiate breathing by poking them sharply in the snout. A technique or device that stimulates breathing might save a greater number of casualties.

The technique is likely to be something simple that can be taught easily to all warfighters and civilians and would be administered by combat buddies or the first people to the scene. It is also possible that a small, automated device that a Soldier would wear on his shirt collar could be incorporated into the Future Soldier System to electronically sense the blast and ensuing apnea and provide a stimulus to reinitiate breathing.

Laboratory/Developer

WRAIR

Antimicrobials for Orthopedic Injuries

- ♦ Antimicrobial Bone Replacement Material
- ♦ Antimicrobial External Fixator Pins

Mission

Through the use of Antimicrobial Bone Replacement Material and External Fixator Pins, the risk of infection from bone fractures will be reduced.

Description

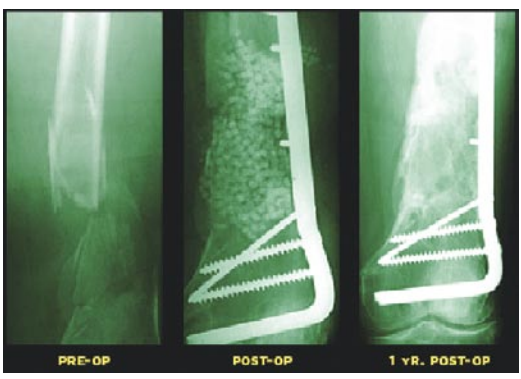
Treatment of casualties in austere environments necessitates that extra precautions be taken to minimize the risk of surgical wound infection. Antimicrobial Bone Repair/Stabilization items are impregnated with antibiotic to reduce or eliminate the occurrence of infection associated with bone fracture injuries.

Antimicrobial Bone Replacement Material. This device will replace lost bone and help stabilize bone fractures.

Antimicrobial External Fixator Pins. Surgical pins and screws will be used to stabilize bone fractures.

Laboratory/Developer

USAISR



Field Sterilizer Improvement Device

Mission

This newly improved sterilizer will reduce the water consumption of the device currently used by the forward-deployed medical facilities.

Description

A vacuum generator will be added to the existing water recovery system that has been developed for the current sterilizer and fully field the Water Recovery System.

While the current field sterilizer is a well-proven piece of equipment, one shortcoming has been its high-water consumption; it uses 2 1/2 gallons of water every time it sterilizes a load of materials. Additionally, the current sterilizer does not have a vacuum system for air removal during sterilization. These shortcomings will be eliminated with the improvements.

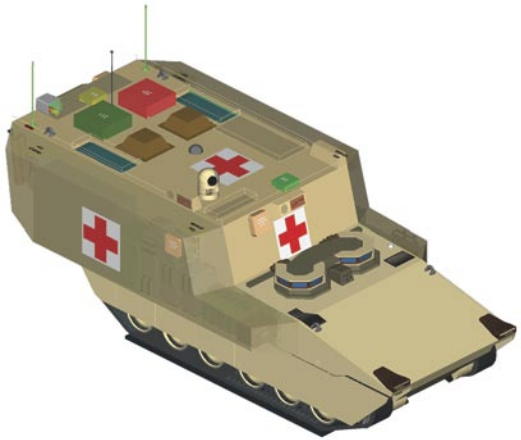
Laboratory/Developer

USAMMDA

Future Combat System – Medical Variants

Mission

Medical variants of the Future Combat System vehicle platform will serve as the ground medical evacuation and treatment assets for the highly mobile, far-forward combat units.



Description

Two medical variants of the Future Combat System are planned: Medical Vehicle–Evacuation (MV-E) and Medical Vehicle–Treatment (MV-T). Medical capability will include on-board oxygen generation, suction, storage space for essential medical items and equipment, and automated data management. The MV-E version will carry four litter patients on an automated litter lift system or six ambulatory patients and a crew of three while the MV-T version will provide interior space for the treatment (surgery) of one patient and a crew of four.

The Future Combat System Medical Variants will provide the capability for medical response assets to move with the far-forward and mobile Units of Action. Additionally, use of the Future Combat System platform yields the same mobility, transportability, and supportability as the supported force.

Laboratory/Developer

PM Unit of Action – Vehicle
USAMMDA – Medical

Future Medical Shelter System (FMSS)

Mission

This future system will provide forward-deployed field hospitals with a transportable, lightweight family of medical shelters.

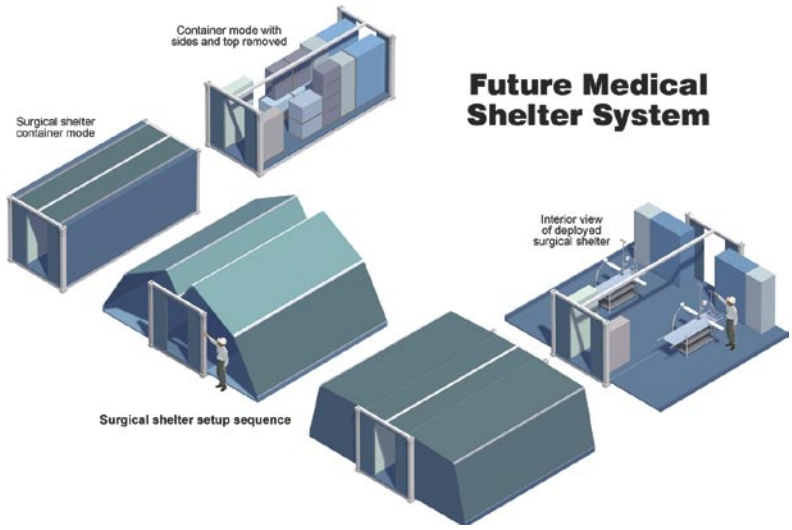
Description

The FMSS is designed with a self-contained emergency response concept in mind and is transportable along with its tactical transport vehicle by a C-130 aircraft. The FMSS consists of chemically/biologically hardened ISO containers with quick erect/strike times and integrated electrical, water, and medical packages, as well as 1,200 square feet of soft tentage as patient care wards.

The FMSS will replace the Deployable Medical Systems (DEPMEDS) operating room shelter. The design reduces the weight of comparable systems and enhances the transportability and deployability of forward medical care by reducing the number of airlift flights required to deploy a field hospital. The transport vehicle provides tactical mobility, a new capability for field hospitals.

Laboratory/Developer

USAMMDA



Portable Automated Laboratory

Mission

A portable laboratory for biodefense use in the field will enable on-the-spot laboratory diagnostics.

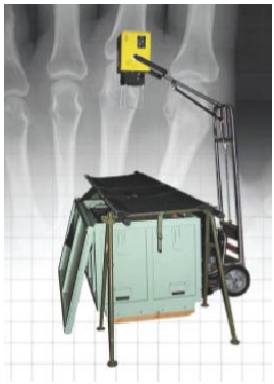
Description

A laboratory for biodefense applications that is suitable for field operations is being developed. The laboratory will be small, automated, lightweight, and power efficient.

In any military conflict or civilian disaster, it is an unfortunate fact that there will be casualties, which will require laboratory tests to determine the full extent of the injury or type of biological contaminant. The Portable Automated Laboratory will provide the capability for early diagnosis and intervention.

Laboratory/Developer

University of Nebraska Medical Center
USAMMDA



Portable Digital X-Ray

Mission

A digital x-ray system suitable for field operations will make available early injury intervention.

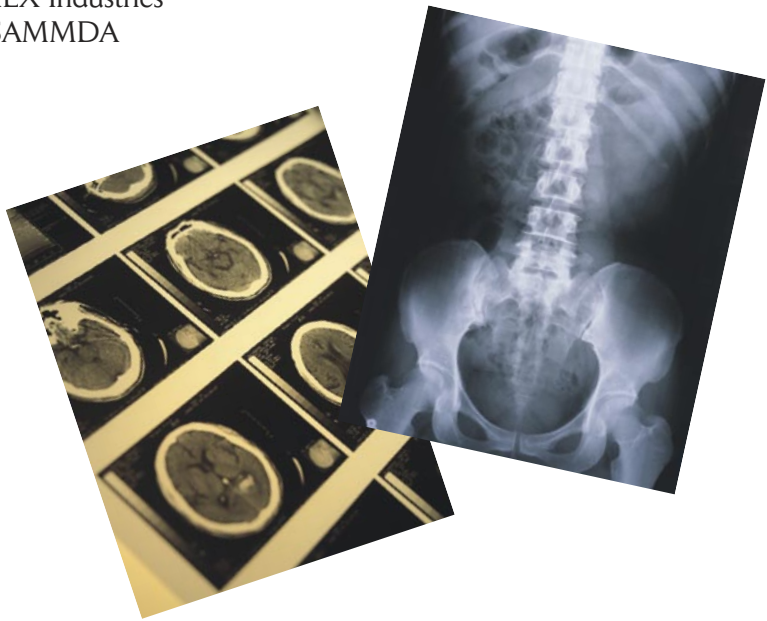
Description

The Portable Digital X-Ray system is a small, lightweight, power-efficient system that uses state-of-the-art detector plates, a small lightweight x-ray source, and a low-power system. No film, chemicals, or water are required. The system can also provide head scans, comparable to CT, when required.

Casualties may require x-rays to determine the full extent of the injury, and head injuries are becoming a larger percentage of combat injuries. The Portable Digital X-Ray system will provide x-ray capability for early intervention in a low logistical footprint package.

Laboratory/Developer

TREX Industries
USAMMDA



Portable Noninvasive Shock Monitor

Mission

The Portable Noninvasive Shock Monitor will assist military medical personnel in preventing mortality and morbidity associated with shock.

Description

Trauma and hemorrhage are a leading cause of death in the United States and a major concern of the military. Significant loss of blood leads to shock, a condition of inadequate organ perfusion, and tissue oxygenation, and there is the need for intelligent medical systems to guide corpsmen and combat medics in triage and resuscitation of severely injured combatants. This project has developed and tested a prototype, portable sensor system based on near infrared spectroscopy to noninvasively measure tissue perfusion. This system quickly and accurately measures muscle pH, muscle oxygen tension, and hematocrit from light reflected off the palm of the hand and will guide combat medical personnel in resuscitation care and evacuation. The prototype device and additional units are currently in clinical trials.

Laboratory/Developer

Congressionally Directed Medical Research Programs (CDMRP)
Luxtec Corporation
University of Massachusetts Medical School

Small Volume Resuscitation Fluids

Mission

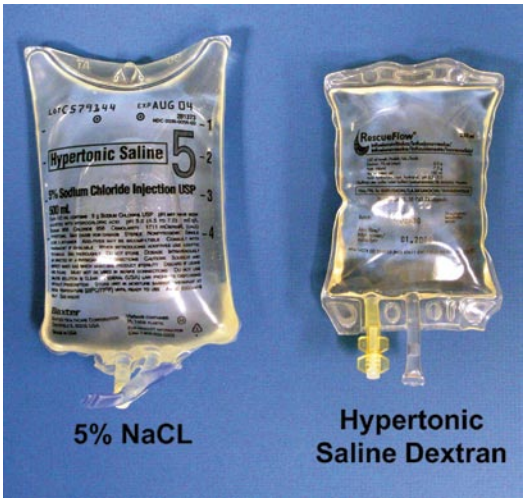
This Small Volume Resuscitation Fluid for fluid resuscitation and hypotension will assist the combat medic, physician's assistant, and surgeon in reducing mortality and morbidity associated with trauma and blood loss while increasing effectiveness of the total fluids carried.

Description

Resuscitation fluids are necessary for the treatment of injured Soldiers who have lost so much blood that their blood pressure is low. Currently, lactated Ringer's and Hextend are available in the field for use. Studies are investigating the potential benefits of small volume hypertonic fluids such as 5% NaCl and hypertonic saline Dextran that may be used by the Future Force.

Laboratory/Developer

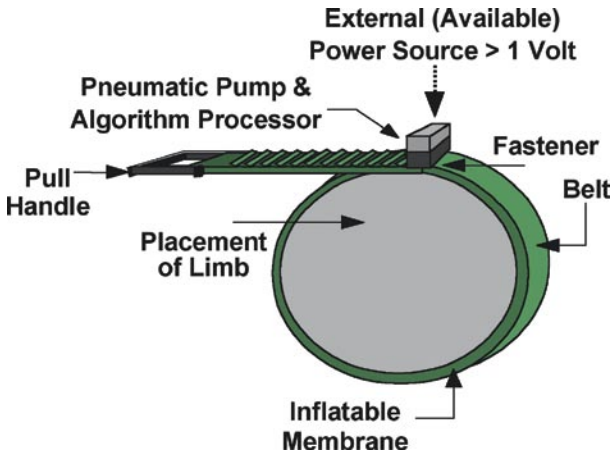
USAISR



Automated "Smart" Tourniquet

Mission

A product automated to control hemorrhage on the battlefield and incorporated into the Future Force Warrior (FFW) ensemble, or as a stand-alone unit for Soldier or buddy use, will avoid improper tourniquet use and reduce limb damage.



Description

The Automated "Smart" Tourniquet is a pneumatic tourniquet that can either be used alone or integrated into the extremity regions of the FFW ensemble. A biosensor unit would inflate the tourniquet upon detection of a severe extremity wound, or in the case of self or buddy use, manual activation would be required. If the pneumatic bladder is punctured, the device can be inflated manually by tightening a thumbscrew. A regulator will be incorporated to ensure the tourniquet is not overinflated.

The regulator function of the tourniquet will provide a significant increase in limb salvage over current generation tourniquets. The ease of releasing and reinflating will allow for the assessment of whether a less damaging pressure dressing could be used instead of the tourniquet, thus avoiding potential limb-damaging consequences of tourniquet use.

Laboratory/Developer

USAISR

Blood Product Shipping and Transport Containers

Mission

Deliver viable blood products from blood banks in the United States to hospitals in the combat theater.

Description

The shipping and transportation containers for blood products are boxes that need no power source to maintain an internal temperature within the ranges required for blood product shipping (4ºC, 20-24ºC, or -20ºC). These boxes are the next generation of the "Golden Hour Blood Container," an award winning, fielded USAMRMC product, that uses a combination of vacuum-insulated panels with an internal container that has a liquid phase-change material similar to that in reusable freezer packs. The internal portion of the container is cooled to below the phase change temperature (effectively frozen) then returned to the container along with the units of blood product. Different internal containers allow the shipping and transport containers to transport packed red blood cells, fresh frozen plasma, or liquid platelets in their appropriate temperature ranges without the use of wet or dry ice.

Blood products will break down and can significantly harm the recipient if not stored at the right temperature. These containers will replace the Styrofoam™ and wet or dry ice currently used to ship blood products. They will allow movement of blood products to and storage of blood products at locations much further forward than the current system allows, thus getting the much needed product to the combat casualty sooner. The product is not blood specific and could be used for transporting any temperature-sensitive products, such as biologicals, vaccines, or reagents. Future versions of the container may incorporate constant monitoring of the internal temperature.

Laboratory/Developer

WRAIR

Clotting Agents

- ♦ Intracavity Hemostatic Agent
- ♦ Intravenous Hemostatic Drugs

Mission

Clotting agents will control internal hemorrhage by medical personnel in far-forward locations.

Description

Clotting agents are drugs or other formulations that act to control bleeding that is not accessible for compression, such as an intra-abdominal hemorrhage. There are no equivalent products currently, and treatment requires immediate surgery. The products will prolong the lives of Soldiers awaiting evacuation.

Intracavity Hemostatic Agent. A foam, gel, or other formulation that can be introduced into a body cavity via a large-bore needle (without surgery).

Intravenous Hemostatic Drugs. Drugs administered via intravascular, oral, or other novel routes of administration that enhance natural clot formation. One such drug is NovoSeven® (recombinant human factor VIIa), which is currently in clinical trials for use in trauma patients.

Laboratory/Developer

USAISR

Complement Inhibitor as a Resuscitation Fluid Adjuvant

Mission

The complement inhibitor, when given in addition to fluid resuscitation, will assist the combat medic, physician's assistant, or surgeon in reducing mortality and morbidity associated with trauma and blood loss.

Description

Hemorrhage and the resuscitation fluids used to treat it cause excessive activation of the complement system, a natural body defense mechanism consisting of a system of proteins meant to protect against infection. However, excessive complement activation will cause tissue damage. Complement activation inhibitors greatly reduce organ injury and reduce the required resuscitation fluid volume in animal tests.

One type of complement inhibitor is already approved by the U.S. Food and Drug Administration (FDA) and used for the treatment of autoimmune disorders, and others will soon be approved for use in cardiac artery bypass graft surgeries. One of these commercially produced complement inhibitors will undergo efficacy testing for a new indication to treat hyperactivation of the complement system during hemorrhagic shock and trauma.

Laboratory/Developer

WRAIR

Freeze-Dried Plasma

Mission

Replacement blood product will be used for control of hemorrhage on the battlefield by the combat medic, physician's assistant, or surgeon.

Description

Freeze-Dried Plasma is a freeze-dried (lyophilized) human plasma packaged for rapid reconstitution and administration. The functional activity of this blood product is similar to native plasma, including the clotting function. Key features are the wide range of environments in which this product can be stored and the ease of carrying a single use unit in a complete, waterproof package.

Freeze-Dried Plasma will reduce the logistical footprint and can be used in a far-forward environment for casualty resuscitation. This product can be carried without adding significantly to the battlefield load of the combat medic.

Laboratory/Developer

WRAIR

Freeze-Dried Platelets

Mission

Replacement blood product will be used for control of hemorrhage on the battlefield and at the hospital by the combat medic, physician's assistant, or surgeon.

Description

Freeze-Dried Platelets are lyophilized human platelets packaged for rapid reconstitution and administration. The functional activity of this blood product is similar to native platelets with regard to the clotting function. A key feature of this product is the wide range of environments in which it can be stored, potentially allowing its use at or near the point of wounding.

Platelets are very important in clot formation after injury or surgery. The current blood-banked platelet product can be stored for only 5 days. The short storage time and difficulty in producing platelets kept this lifesaving fluid out of the combat theater in Operations Enduring and Iraqi Freedom for the first 2 years. Freeze-Dried Platelets will reduce the logistical footprint, can be used in a far-forward environment for casualty resuscitation, and can be carried without adding significantly to the battlefield load of the combat medic.

Laboratory/Developer

WRAIR

Hypertonic Saline Dextran (HSD)

Mission

This low-volume resuscitative fluid will aid medics and forward-deployed medical personnel in the management of traumatic hypotension and hemorrhagic shock.

Description

HSD is a small-volume resuscitative fluid of 7.5% sodium chloride and 6% Dextran 70. Vascular fluid volume is increased and maintained by the osmotic properties of the solution pulling water from the surrounding tissue into the blood stream. For a 1,000 milliliter blood loss, a 250 milliliter infusion of HSD is required and will provide resuscitative support for 4 to 6 hours. The product is marketed outside the United States under the trade name of "Rescue Flow."

HSD is a concentrated resuscitation fluid that requires one-twelfth the volume of current fluids. The product provides an alternative to blood and blood products for fluid resuscitation, along with reductions in weight and cube for logistical support. The medic will use this product far forward to replace lost blood and allow the casualty to be evacuated to available medical assets further back, again reducing the logistical burden far forward.

Laboratory/Developer

BioPhausia AB
National Heart, Lung, and Blood Institute
NIH/DoD – PULSE, Research Outcome Consortium
USAMMDA

Liquid Tourniquet (Hemostatic Gel)

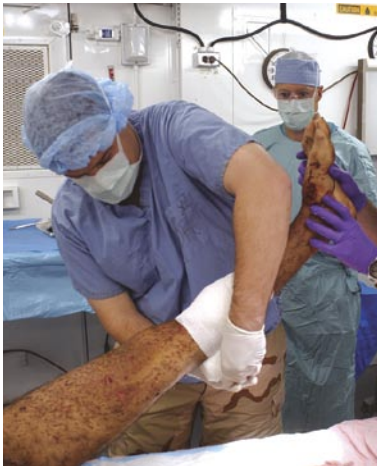
Mission

Control of hemorrhage by Liquid Tourniquet on the battlefield by Soldier or buddy will stabilize wounds and protect the injured from contamination.

Description

The Liquid Tourniquet, or Hemostatic Gel, is a lightweight polymerizing gel that is used for compressible hemorrhage or amputation. Polymerization of the gel occurs in less than 2 minutes. The material will provide several days of wound stabilization and protection from environmental contamination. For field use, the Liquid Tourniquet will be packaged with field dressings and one-handed tourniquets.

The Liquid Tourniquet will increase survivability of muscle and tissue currently lost due to long-term (greater than 2 hours) tourniquet use. The time required for use of a standard tourniquet will be reduced to less than 15 minutes, as once the gel is hardened the tourniquet can be removed. The material allows for the stabilization of wounds for several days under battle conditions.



Laboratory/Developer

USAISR

Optimal Fluid Resuscitation Guidelines

Mission

Guidelines for administration of resuscitative fluids by medics and forward-deployed medical personnel will provide optimal fluid resuscitation for wounded Soldiers.

Description

Using current understanding, a set of guidelines will be developed regarding optimal fluid resuscitation in injured warfighters who have experienced substantial blood loss and may experience long delays in evacuation.

The guidelines will reduce or eliminate consequences frequently associated with fluid replacement after severe blood loss.

Laboratory/Developer

USAISR
WRAIR

Remote Acoustic Hemostasis

Mission

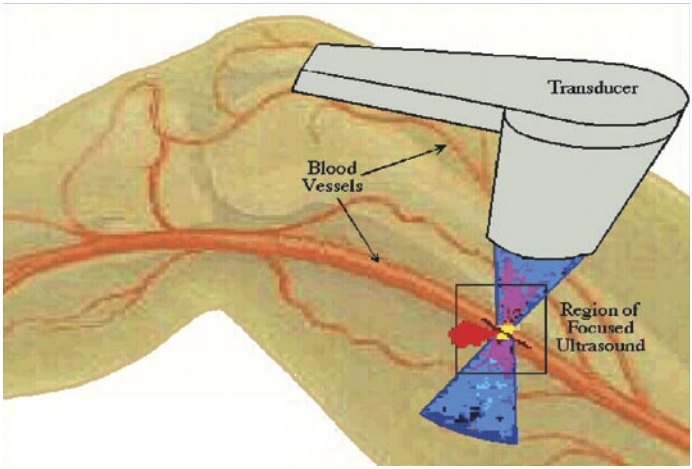
Internal bleeding is one of the largest causes of death on the battlefield. Control of internal hemorrhage by the Remote Acoustic Hemostasis device will stabilize the bleeding.

Description

This high-intensity focused ultrasound device functions by focusing ultrasonic waves to cause cauterization of both internal and external bleeding structures without damaging overlying or surrounding tissues. The Remote Acoustic Hemostasis device will feature a computerized Doppler guidance system designed to locate and focus on hemorrhaging structures.

Laboratory/Developer

USAISR



Spray-On Protective Bandage

Mission

Wound stabilization is critical on the battlefield. The spray-on bandage can be self or buddy applied and will be used by the combat medic, physician's assistant, or surgeon for small and large wounds.

Description

The Spray-On Protective Bandage is a self-sanitizing (antimicrobial), flexible bandage that will reduce or eliminate blood and fluid loss (hemostatic), reduce or eliminate pain (analgesic) associated with motion, and protect wounds from environmental contamination. The bandage is capable of reducing or stopping blood and fluid losses (including compressible hemorrhage and amputation stumps after minimal tourniquet control). Wound stabilization is provided for 2 or more days after injury. It may be used in conjunction with enzymatic/chemical debridement.

This product is easily applied on the battlefield and allows mobility for the warfighter with small wounds. Large wounds can be stabilized following initial treatment with compression-style/hemostatic dressings or minimal tourniquet use.

Laboratory/ Developer

USAISR

Rapid Wound Cleansing System

Mission

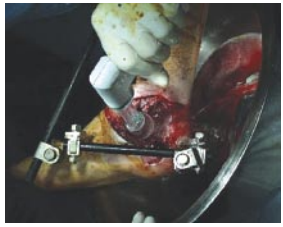
Rapid wound cleaning is necessary to avoid wound sepsis and achieve optimal healing. This wound cleansing system will replace the heavier current system.

Description

Reducing the amount of fluid and the weight a medic carries without compromising care is important for the medic's mobility on the battlefield. The product will be a small-volume wound cleaning (debridement) device. The replacement of the current system will reduce the required volume from 12 liters to less than 2 liters.

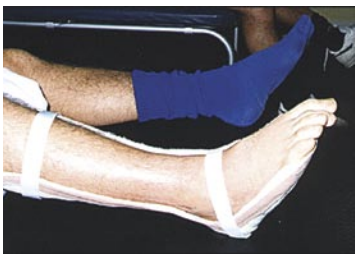
Laboratory/Developer

USAISR



Splints, Extremity and Pelvic

- ♦ Lightweight Extremity Splint
- ♦ Pelvic Fracture Stabilizer



Mission

Immobilization of bone fractures is vital to prevent further injury. These new splints will not only prevent further injury but will also in some cases allow continued mobility by the injured Soldier. The splints will be used on the battlefield by buddy care, the combat lifesaver, combat medic, physician's assistant, or surgeon.

Description

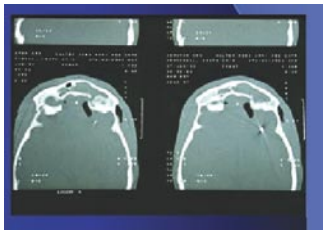
The Lightweight Extremity Splint. Replacing the current board splints, this splint is a spray-on contractible or pneumatic expandable splint fabricated from new, lightweight material(s) and deployable far forward in the battle area. Soldiers with immobilized and nondisplaced fractures may be able to continue their mission, and Soldiers with serious open fractures may be stabilized and transportable for several days under battle conditions. The splint will enable the Soldier with a single upper extremity fracture to remain functional, perhaps even operating an individual weapon until evacuation. A Soldier with a lower extremity fracture may be able to evacuate with crutches or one other person instead of a stretcher evacuation team.

The Pelvic Fracture Stabilizer. This splint system will stabilize a fractured pelvis to facilitate movement of injured patients without risk of further pelvic organ damage due to pelvic instability. Pelvic fractures are very difficult to immobilize and stabilize, especially during evacuation from the battlefield via man-carried litter or ambulance.

Laboratory/Developer

USAISR

Neuroprotective Drugs



Mission

Neuroprotective drugs will improve the outcome following acute brain trauma.

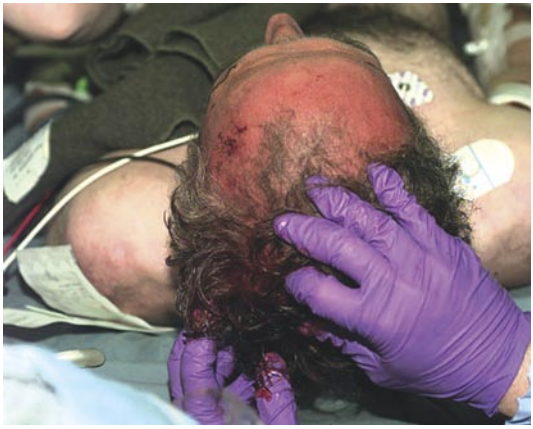
Description

Two neuroprotective drugs will be developed to protect injured brain tissue, enhance neuronal repair and functional recovery after brain trauma, and stop the development of silent brain seizures occurring as a deleterious consequence of a penetrating brain injury.

Neurological trauma is the number one cause of traumatic mortality on the battlefield and is often associated with significant morbidity, disability, and/or delayed mortality in those who survive the initial insult. A neuroprotective drug used to preserve or protect otherwise uninjured neurological tissue in the face of direct penetrating head trauma will reduce residual disability and subsequent long-term care demands. The capability to stimulate or enhance neuronal healing and repair as well as functional recovery will further reduce residual disability.

Laboratory/Developer

WRAIR



Neurotriage Diagnostic Tools

Mission

Diagnostic tools will guide the combat medic and others to rapidly assess and triage brain injury casualties.

Description

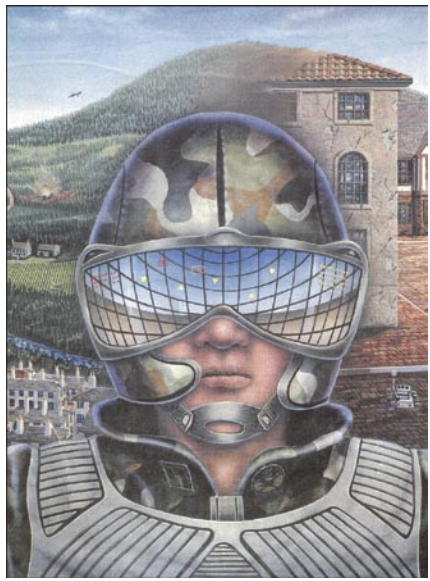
A rapid, field-implementable, diagnostic device will be developed for the objective assessment of neurological trauma – the number one cause of mortality on the battlefield. A small volume of blood will be analyzed to determine the levels of brain-specific biomarkers. The results of this bioassay will be combined with an analysis of physiological parameters from the casualty's Warfighter Physiological Status Monitoring system to provide a diagnosis of injury magnitude, ascertain casualty triage status, and provide treatment recommendations specific to the casualty's condition.

The diagnostic tools being developed will help manage the injury and may reduce subsequent residual disability and associated long-term care demands.

Laboratory/Developer

WRAIR

Automated Trauma Treatment Future Force Warrior Suit



Mission

Medical monitoring and trauma treatment devices will be integrated into the FFW suit to provide initial wound treatment, thereby reducing severity and consequences.

Description

On the Future Force battlefield, the FFW is widely dispersed with the potential for significant delays in treatment of combat casualties. The medical technologies embedded in the FFW uniform ensemble will initiate treatment of the Soldier immediately after wounding, thereby extending the chance of survival until treated by a medic, reducing subsequent residual deficits, and enhancing the likelihood of early return to duty.

The FFW uniform will include wound detection and location abilities; integrated closed-loop, servo-controlled tourniquets; embedded autoinjectors for injecting enhanced clotting agents, analgesics, and antibiotics into the wounded Soldier; physiological monitoring to provide the combat medic with remote casualty triage capability; and knowledge-based systems that use monitored physiological data to provide the medic with diagnosis and treatment options.

Laboratory/Developer

USAISR
USARIEM
WRAIR

Monitors

- **Non-contact Heart Monitor (Vital Signs Monitor 1)**
- **Non-contact Respiration Monitor**

Mission

These devices will provide combat medics with the ability to assess vital signs of casualties enclosed in protective gear.

Description

These devices allow monitoring of casualties enclosed in chemical protective overgarments, without exposing either the patient or medical personnel to a contaminated environment. Mass casualty triage and high noise and vibration evacuation environments are situations where these monitors will be useful.

Non-contact Heart Rate Monitor. A handheld diagnostic attachment to the Warrior Medic system, or a stand-alone system that will measure life signs in wounded Soldiers. Sensors measure heart rate, and possibly cardiac stroke volume, to assess the injury status of the patient, and artificial intelligence coding provides treatment suggestions.

Non-contact Respiration Monitor. A small, self-contained monitor that attaches to a gas mask filter canister, or is incorporated in the gas mask, will sense the flow of air entering the gas mask and indicate the state of breathing audibly and visually.

Laboratory/Developer

USAMMDA
WRAIR

Pneumothorax Detector (Vital Signs Monitor 2)

Mission

Early detection of a collapsed lung will help avoid later complications in treatment. With this device, medics and forward-deployed medical personnel can diagnose a collapsed lung in a patient with a chest wound.

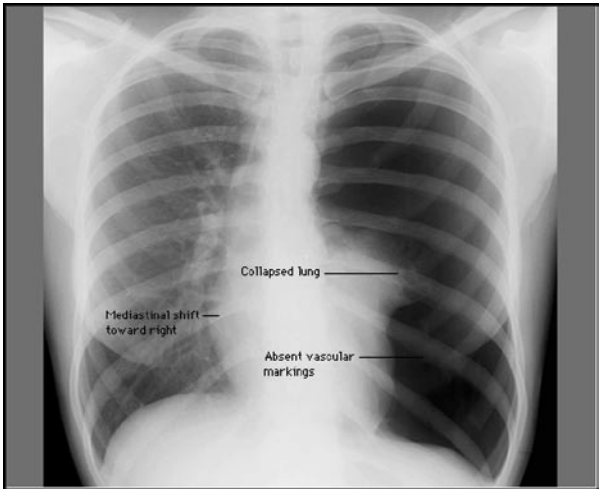
Description

The Pneumothorax Detector indicates the presence of a collapsed lung (pneumothorax) in patients with chest wounds. Measurements are made noninvasively using either breath sounds or microwaves.

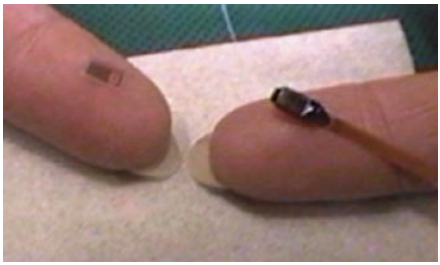
Penetrating wounds of the chest can result in a collapsed lung that if not readily identified can further complicate treatment. The Pneumothorax Detector replaces radiography for diagnosis and will help guide the rapid, appropriate management of a collapsed lung.

Laboratory/Developer

WRAIR



Temporary Implantable Lactate Sensor Biochip



Mission

The goal of this project is to develop an implantable lactate-sensing biochip for temporary implantation that is capable of telemetered reporting of local lactate levels that can indicate level of injury and hemorrhage risk.

Description

Following injury that results in tissue hypoxia, interstitial lactate levels increase and are the main source of metabolically produced acid responsible for tissue acidosis. Lactate levels have also been found to correlate with the severity of injury, including hemorrhage. In preliminary development studies these biochips are temporarily implanted into a skeletal muscle bed of animals. Lactate levels are continuously monitored for implantation periods varying from several hours to 3 months and include testing in a model of severe hemorrhagic shock.

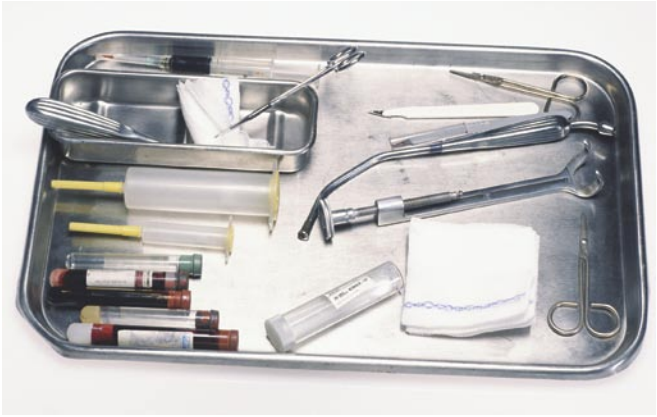
Laboratory/Developer

CDMRP
Virginia Commonwealth University

Thirty-Minute Cold Sterilization Solution

Mission

An alternate method of sterilization will reduce reliance on larger, less mobile sterilization equipment for use by far-forward dental personnel, Special Forces medics, and Forward Surgical Teams (FSTs).



Description

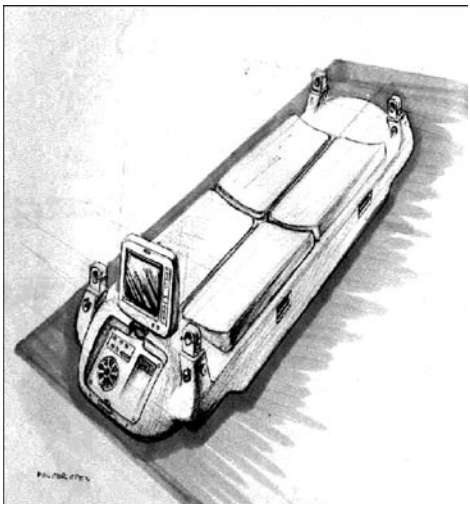
The cold sterilization solution is produced by reconstituting a dry chemical compound with water. Following mechanical cleaning, instruments are soaked in the solution for 30 minutes to sterilize them.

Medical and dental care requires sterilization of instruments that is typically done with steam, heat, or chemicals, alone or in combination, using relatively large equipment. Field medical and dental personnel carry a limited number of pre-sterilized instrument packs, and once used, the instruments must be re-sterilized prior to reuse. The cold sterilization solution will reduce the logistical burden associated with maintaining a supply of sterilized instruments.

Laboratory/Developer

WRAIR

Transportable Automated Life Support System (TALSS)



Mission

The TALSS will provide automated life-support capability up to 72 hours on the battlefield for surgical and postsurgical environments including the en route care transport of patients during recovery and evacuation.

Description

Also known as the Trauma Pod, the TALSS represents the next development phase of the Critical Care System for Trauma and Transport development. The system is a portable, self-contained, lightweight (less than 40 pounds), protected environment for one casualty. Life-support functions are automated including computer-driven, closed-loop control of ventilation, fluid, drug, and oxygen administration. It also incorporates data logging and telecommunication capabilities to facilitate record keeping and to enable real-time communication of patient data to the receiving hospital for assistance with monitoring and decision assistance from a remote location.

The TALSS/Trauma Pod system automatically optimizes the patient's treatment while freeing the medical staff to care for other casualties once they have stabilized a seriously injured casualty. The system will provide increased and improved holding capability at the FST as well as extended critical care capability within the ground and air ambulance platforms.

Laboratory/Developer

WRAIR

Warfighter Remote Triage

Mission

Remote monitoring of wounding/vital signs capability via the Land Warrior Suit will enable the combat medic to attend to the most critically injured first.

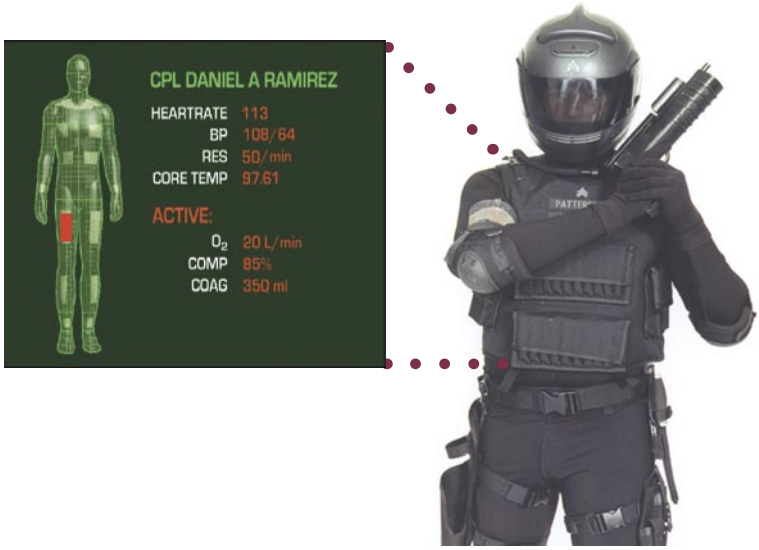
Description

A minimal set of sensors to detect wounding and monitor vital signs will be embedded in the FFW suit to diagnose and evaluate a casualty's physiological status and triage priority from a remote location to focus and optimally direct the medic's lifesaving skills to the appropriate casualty. Future Force Medics will have a small and wearable personal computer capable of interfacing with physiological sensors and of hosting diagnostic algorithms that will provide medical decision assistance and the capability to send information through the medical alert system.

Warfighter Remote Triage aids in the medic's diagnosis and treatment of casualties, thereby enhancing survivability.

Laboratory/Developer

WRAIR



Subcategory: Dental

Anticaries Components

Mission

Reduction of dental plaque-related emergencies in deployed forces via field ration additives will significantly mitigate or eliminate the impact of dental disease and dental trauma on military forces.

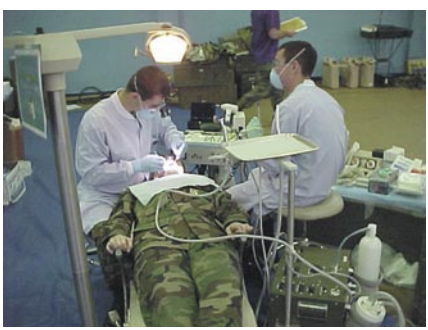
Description

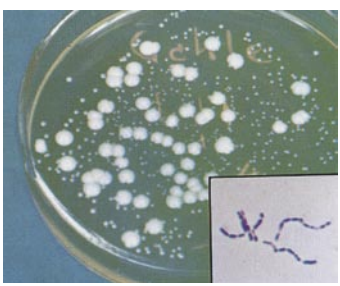
The Anticaries Components constitute a system of simple, safe, FDA-approved chemical additives, including antimicrobial peptides, to field rations.

Dental problems cause a significant percentage of lost duty time, and in the austere environment of lengthy deployments and combat, lack of good dental hygiene practice is commonplace. The Anticaries Components will help prevent the occurrence of dental plaque-related emergencies in deployed forces.

Laboratory/Developer

WRAIR



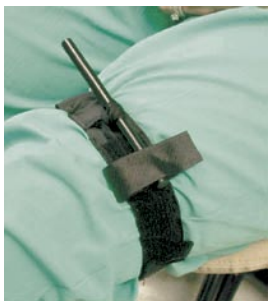


Blood Products Bag

- A system for the collection, lyophilization, and/or storage of lyophilized (freeze-dried) blood products.
- Provides the packaging necessary to fully utilize advances in the preservation of whole blood and blood products.
- Completed date: 2003.

Chitosan Hemorrhage Control Dressing

- Manufactured using a natural biomaterial (chitosan, a component of shellfish). Will stop severe arterial/venous bleeding.
- Once applied, the dressing tightly adheres to the injury site, forming a strong durable clot. FDA approved for external use only; development of an internal-use version currently under way.
- Completed date: 2003.
- Used in Operation Enduring Freedom and Iraqi Freedom.
- Named one of the Army's 10 Greatest Inventions for 2004.

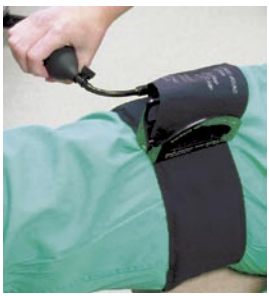


Combat Application Tourniquet (CAT)

- A lightweight (60 g), easy-to-use tourniquet for hemorrhage control in severely bleeding extremities. The CAT is a strap-type tourniquet with a built-in stick (windlass) for tightening.
- Allows rapid, effective control of extremity hemorrhage for self, buddy, or medic application in far-forward locations.
- Completed date: 2004.

Demand Oxygen Controller

- An oxygen controller that senses breathing and oxygen rates.
- Reduces the required amount of oxygen to one-third the usual amount needed for standard ventilation.
- Completed date: 1989.



Emergency and Military Tourniquet (EMT)

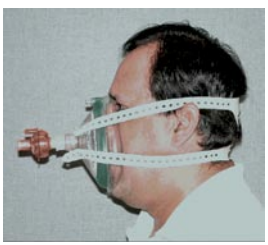
- A pneumatic tourniquet that is easy to use for hemorrhage control in severely bleeding extremities. Its greater weight (240 g) and size make it more appropriate for medic kits/medical vehicles. Potentially less damaging to underlying tissues.
- Rapid and effective control of extremity hemorrhage for self, buddy, or medic application in far-forward locations.
- Completed date: 2004.

Field Medical Oxygen-Generating and Distribution System (FMOGDS)

- A lightweight system that provides bedside and cylinder-refill oxygen capabilities.
- Provides greater mobility and flexibility with reduced logistics dependence on medical-grade oxygen resupply.
- Completed date: 1993.

Golden Hour Blood Container

- A transportation container that can hold four units of red blood cells and needs no power source to maintain its internal temperature. Uses a combination of vacuum-insulated panels and an internal container that has a liquid phase-change material like reusable freezer packs.
- At room temperature units of blood cells can last 121 hours, at well below freezing (-9°F) for more than 97 hours, and at 105°F they are good for more than 78 hours.
- Extends the amount of time a medic can transport blood products and allows for the extended evacuation times necessary for far-forward combat units.
- Completed date: 2003.
- Named one of the Army's 10 Greatest Inventions for 2003.



Impedance Threshold Device (ITD)

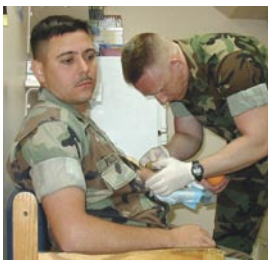
- A small lightweight plastic valve that attaches to a standard facemask or mouthpiece and acts as a temporary resuscitation device that requires no power.
- Results in a vacuum within the thorax during each inspiration to increase central blood volume and cerebral blood flow reducing the risk of hemorrhagic shock.
- Completed date: 2005.
- Used in Operation Iraqi Freedom.

Individual Chemical Resuscitation Device

- Provides manually operated positive pressure respiratory resuscitation to assist in the restoration of normal breathing of a battlefield casualty. Filters chemical warfare agents from ambient air and can be used with an oropharyngeal mask or cricothyroid cannula.
- Completed date: 1987.

Low-Power Blood Cooling and Storage Device

- A storage and transport device for blood and fluids to provide greater flexibility and reduce the logistical strain of storage at all levels of medical care from field hospitals to the battlefield.
- Extends the capability of the current blood refrigerator and cools fresh whole blood using very low power requirements.
- Completed date: 2002.
- Used in Operation Iraqi Freedom.

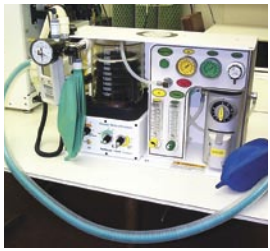


Rapid Blood Sterilization System

- A purification system that allows medics to collect whole blood from a donor, sterilize it, and place it into a recipient in a matter of only a few hours.
- Enables the rapid sterilization of blood products for use on the battlefield as well as blood banks.

Rapid IV Infusion Pump

- A portable electronic infusion pump that delivers IV fluids to restore blood pressure and intravascular volume. Battery operated, about the size of a deck of playing cards.
- Can be used far forward on the battlefield or in the transport of patients.
- Used in the Global War on Terror.



Ventilatory Assist Device for Anesthesia Machine

- An integrated ventilator and anesthesia machine that ensures proper ventilation of patients during surgery and is compatible with low-pressure oxygen sources such as oxygen generators and concentrators.
- Provides FSTs with the ability to properly ventilate a wounded Soldier while replacing the more labor-intensive system of an anesthetist hand bagging the patient and reducing equipment load.
- Completed date: 2005.
- Used in Operation Iraqi Freedom.

AMEDD Interim Tent System

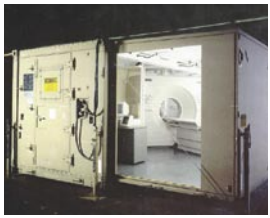
- Replacement for the TEMPER tents in DEPMEDS hospitals that will provide lighter, brighter, and more environmentally resistant patient areas.
- Future plans call for air beam technology to reduce weight by two thirds and setup time by half; will become the Future Force tent system.
- Completed date: 2004.

Armored Medical Evacuation Vehicle

- A medical interior for an existing armored vehicle that provides protection from chemical/biological agents, an environmental control system, and a separate power source for medical systems. Telemedicine and life support for trauma and transport capabilities are included with equipment for ventilation, suction, and vital signs monitoring.
- Replacement for the M113 armored ambulance for use in the evacuation of patients from the battlefield. Provides mobility, survivability, and the ability to rapidly treat combat casualties.
- Completed date: 1998.

CWA Protective Patient Wrap

- Protects patients from chemical warfare agents (CWA) during evacuation in a field environment.
- Completed date: 1987.

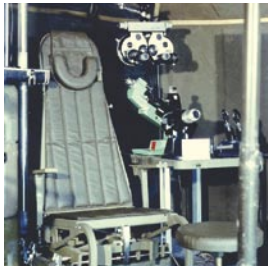


Field CT Scanner

- A commercial x-ray computed tomography (CT) system that is shock mounted and installed in an International Standard Organization Shelter.
- Provides diagnostic quality CT information.
- Completed date: 1993.

Field Operating Table Improvement

- Fixes problems with rigidity and the elevation gearing of the past version.
- Weight and size are significantly reduced from the DEPMEDS table currently in use.
- Completed date: 2004.



Field Optometry Set

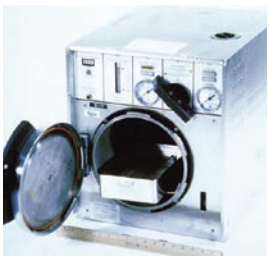
- Contains field operational optometric equipment, including examinee chair, instrument pole, supporting accessories, optometric instrumentation, and field chests.
- Completed date: 1988.

Fluid Warming System

- A small, lightweight fluid warming system for blood, lactated Ringer's solution, Hextend, and other fluids to be used in far-forward areas.
- Extends quality care further forward on the battle area and allows for extended evacuation times.

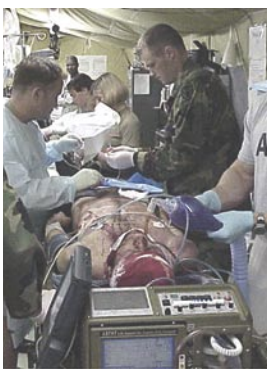
Folding Decontaminable Litter

- Litter consists of aluminum poles and spreader bars, a polypropylene mesh fabric, and retractable nylon handles.
- All components are resistant to chemical agents and decontaminating solutions.
- Completed date: 1990.



High-Speed Mini-Sterilizer

- A tabletop device with an inner chamber approximately 10 inches wide by 12 inches deep that sterilizes with bursts of steam on a cycle of approximately 1 minute.
- Later replaced with a commercial item.
- Completed date: 1986.

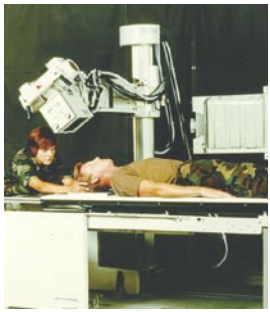


Life Support for Trauma and Transport (LSTAT)

- A portable, single-patient, trauma casualty care and surgical support platform that combines advanced diagnostic and therapeutic technologies with a self-contained critical care life-support and evacuation system. Incorporated in the platform are a defibrillator, ventilator, vital signs monitor, infusion pumps for fluid resuscitation and administration of medications, suction unit, self-contained oxygen supply, and patient physiological data recording.
- Developed to meet Critical Care System for Trauma and Transport requirements.
- Completed date: 1990.
- Used in Operation Iraqi Freedom and Operation Enduring Freedom.

Medical Supply Envelope

- A fabric container with pockets for the storage, transportation, and dispersement of medical supplies required at a triage site.
- A unit, prepackaged with critical supplies, will fit into a medical chest and can be retrieved for immediate use.
- Completed date: 1992.



Military Transportable Field Radiographic and Fluoroscopic System

- Radiographic and fluoroscopic system that incorporates solid-state electronics, composite materials for lightweight construction, and military-specific components for system reliability.
- Also referred to as the High-Capacity X-ray System.
- Completed date: 1987.

Patient Holding and Evacuation Heater Unit

- Provides protection against the cold for casualties during evacuation when used with existing evacuation bags.
- Completed date: 1987.

Portable Field X-Ray Table

- A lightweight platform for positioning patients for medical imaging in the field.
- Weighs less than 100 pounds and has a "buckey system" to allow patient imaging in either the horizontal or vertical position.
- Completed date: 1999.

Special Medical Emergency Evacuation Device (SMEED)

- A lightweight platform that attaches to a North Atlantic Treaty Organization litter and accommodates patient movement items for evacuation.
- Provides a platform with modular flexibility and significantly improves the ability to evacuate ventilated patients with multiple IVs and monitors.
- Completed date: 2004.
- Used in Operation Iraqi Freedom.

Steam Vacuum Pulse Sterilizer

- A ruggedized, highly reliable sterilizer for field hospital use with large throughput.
- Employs a pressure/vacuum pulsing-conditioning principle for air removal and is designed to sterilize instruments, linens, and solutions.
- Completed date: 1991.

Stryker – Medical Evacuation Vehicle

- Medical evacuation variant of the Stryker Armored Vehicle platform for the Stryker Brigade Combat Team.
- Capability includes an automated litter lift system, on-board oxygen, suction, storage space for essential medical items and equipment, plus the capacity to carry four litter patients or six ambulatory patients and a crew of three.
- Completed date: 2003.
- Used in Operation Iraqi Freedom.

Warrior Medic

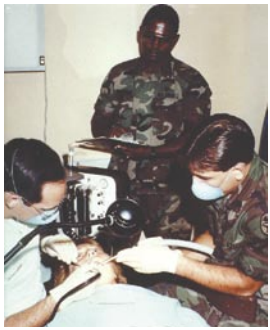
- An enhancement to the Land Warrior System that provides state-of-the-art protective, visual sensor, navigation, and weapon-targeting warfighting equipment. The Warrior Medic System consists of the Land Warrior Leader configuration, excluding the weapons subsystems, with enhancements to include electronic casualty reporting for all Soldiers and access to applicable electronic medical field manuals.
- Enables wounded Soldiers or their buddies to instantaneously send an emergency "Call for Medic" with location to both the combat medic and commander.
- Increases medical situational awareness and reduces the time from occurrence to treatment of battlefield casualties.
- Completed date: 2004.

Dental Field Treatment and Operating System (DEFTOS)

- A small, lightweight, mobile dental operating system for dental officers in the field that uses the latest electric motor-driven handpiece technology and can be quickly assembled or disassembled and packed into one molded shipping container reducing the footprint of the field dental operating unit.
- Includes both a high-speed and low-speed handpiece, air/water supply, air/water syringe, high-volume evacuator, saliva ejector, variable-speed foot switch, and oil-less air compressor.
- Completed date: 2003.
- Used in Operation Iraqi Freedom.

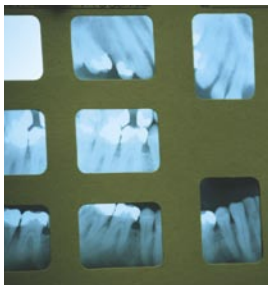
Dental Filmless Imaging System

- A system consisting of an x-ray detector and image acquisition and storage components to digitize images for storage and viewing. Compatible with currently fielded x-ray sources. Images are available immediately for the treating dentist.
- For use by forward-deployed dental technicians and officers. Replaces conventional x-ray film, film processors, and the associated chemicals, eliminating the logistical burden of temperature- and time-sensitive components. Also, volume, weight, and power requirements are reduced.
- Completed date: 2002.



Field Dental Operating Unit

- A small, lightweight, mobile dental unit to be used to provide emergency and limited preventive/sustaining dental care in the field.
- Consists of a light source, suction apparatus, water reservoir, and high- and low-speed drills.
- Completed date: 1990.



Miniature Dental X-Ray System

- A small, lightweight, handheld dental x-ray system for field use. Battery operated and suitable for use with self-developing film or a digital imager.
- Completed date: 1993.

Military Infectious Diseases

Combat Casualty Care

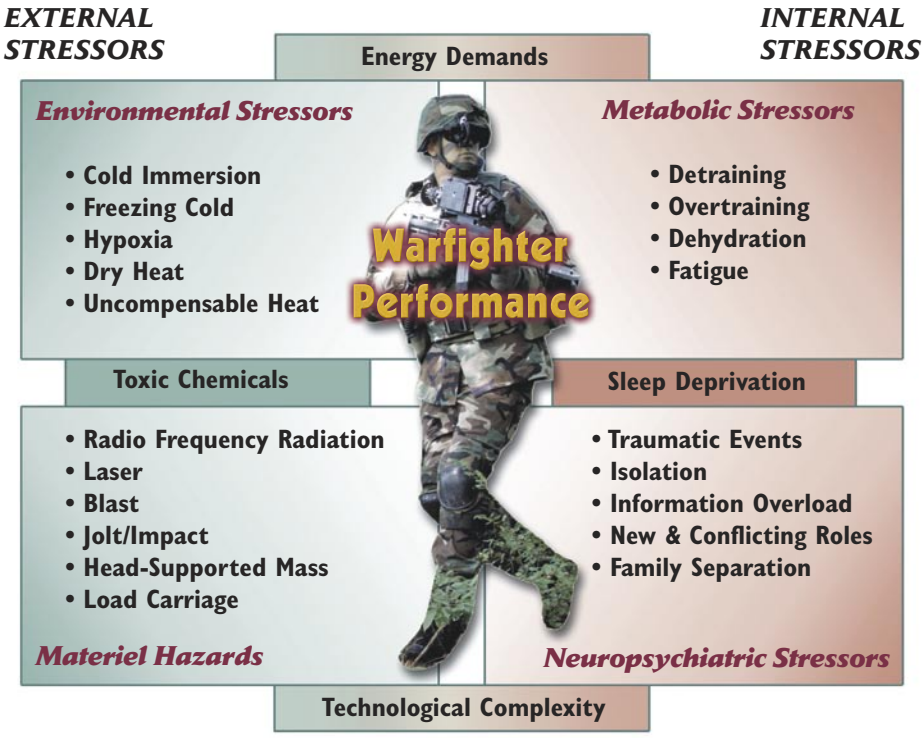
Military Operational Medicine

Medical Chemical and Biological Defense

Telemedicine, Logistics, IM/IT, and Facilities

Overview

Soldiers' living and working conditions can be unlike any that civilian workers face. The Military Operational Medicine Research Program (MOMRP) provides biomedical "skin-in" solutions that protect Soldiers and enhance their performance in operational and training environments that include multiple internal and external stressors. It is a unique biomedical research program with relevant core capabilities, a problem-solving orientation, and a human physiology research focus.



The MOMRP represents unique expertise in both health and performance effects of multiple interacting operational hazards and stressors. The focus is on multistressor interactions involving human tolerances, metabolic physiology, and brain functioning. The core biomedical research is organized into 13 core research capabilities that cover a broad range of research areas and provide the basis for the organization of this section:

- Bioenergetics
  - Bioenergetics and metabolism
  - Physiological monitoring and predictive modeling
  - Environmental extremes
- Injury biodynamics
  - Brain and spine injury hazards
  - Pulmonary injury hazards
  - Occupational task performance and injury prevention
- Neuropsychology
  - Cognitive performance assessment
  - Stress and psychological resilience
  - Fatigue and performance modeling and interventions
- Psychophysics
  - Nonionizing directed energy and bioeffects
  - Biomedical aspects of visual and auditory performance
- Force health protection
  - Deployment and post-deployment health protection
  - Environmental health risk assessment methods

Current operations in Iraq, Afghanistan, and Bosnia have illustrated the urgent need for the biomedical solutions that the MOMRP provides. The Soldier standing his watch, the pilot securing her helmet, or the commander leading his troops in the field are all affected by research that the MOMRP provides. The resulting products of this biomedical research transition to Army planners, doctrine and materiel developers, and the Army medical community.

Examples of the MOMRP's biomedical research products include physiological response models and tools for mission planning, equipment design specifications and guidelines based on human tolerances, physiologically based nutritional guidelines for ration developers, strategies to enhance psychological resilience, and injury prediction tools for health hazard and Soldier survivability assessors. These products ultimately protect Soldiers, enhance their performance, and provide the "best available" answers for immediate military decision making.

The MOMRP conducts collaborative research with university and commercial laboratories and other federal agencies oriented toward solving critical problems facing the Army today and in the future. Service- and platform-specific issues are addressed through close coordination with Navy and Air Force counterparts to prevent duplication of effort. The MOMRP uses an independent, external scientific peer review process to ensure high quality and validity of its research, review milestone accomplishments, and prepare these findings for publication in the open scientific literature.

General Peter J. Schoomaker, Chief of Staff of the Army, has written:

> *"Our individual and organizational approach to our duties and tasks must reflect the seriousness and sense of urgency characteristic of an Army at war. Our Soldiers and our nation deserve nothing less. This is* not *business as usual."*

The MOMRP understands this level of seriousness and sense of urgency and is committed to providing timely and relevant biomedical products and solutions that protect our Soldiers and enhance their performance during training and on the battlefield.

Hydration Management for Future Force Missions

Mission

Enhance Soldier capability to sustain performance and health in extreme environments; reduce logistical burden for water delivery and reduce medical burden from environmental injury.

Currently, we cannot accurately predict water needs for many modern Future Force type missions. Neither water needs nor dehydration consequences in cold weather or high terrestrial altitude missions are understood, so the criticality of supplying water in such logistically difficult environments is also unknown. Countermeasures are needed to improve water and nutrient intake, increase consumption of chlorinated water, and minimize adverse performance consequences of dehydration.

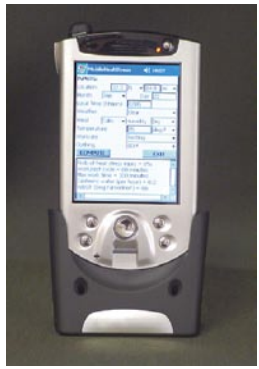
Description

This research effort exploits new knowledge on water needs and adverse performance consequences from dehydration. New doctrine and sweat prediction software will improve prediction of water needs while the enhanced fluid and nutrition delivery system (EFDS) will optimize soldier intakes. Both will reduce hydration-related heat injury incidence while also sustaining performance. The logistical water supply burden will be minimized by reducing water procurement error and increasing potable water consumption due to the presence of a flavoring agent, but without water hygiene concerns. Nutritional supplements will minimize adverse performance outcomes of dehydration.

Laboratory/Developer

U.S. Army Research Institute of Environmental Medicine (USARIEM)

Thermal Models on a PDA Format



Mission

Improvements in predicting heat casualty risk during operations will enhance Soldier performance and reduce both heat strain and injury.

Description

USARIEM has developed a Heat Strain Decision Aid (HSDA) model that runs on a personal digital assistant (PDA) for predicting the risk of heat casualties. The HSDA is the best available, user-friendly predictor of endurance times in thermally challenging environments within the DoD. It is especially well adapted to military and first responders performing military or paramilitary activities in nuclear, biological, and chemical (NBC) protective ensembles with or without body armor.

At present the model requires separate input of clothing, work activity level, and environmental conditions; calculates maximum work time to 300 minutes; recommends work/rest cycles for sustained operations; and estimates water consumption requirements.

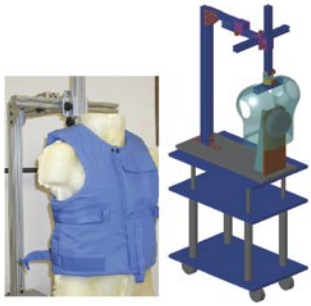
Laboratory/Developer

USARIEM

Body Armor Blunt Trauma Test Method

Mission

Develop a biomedically valid testing method for Army body armor developers. The testing method will enable developers to design and field effective, lightweight, and comfortable body armor systems for Soldiers.



Description

Today's body armor systems are very effective in protecting Soldiers from penetrating and blunt trauma injuries, but these systems are heavy and restrict the wearer's movement. Effective, lightweight, and flexible ballistic materials are available, but there is no biomedically valid test method and performance standard available to ensure these newer materials can confidently protect Soldiers from blunt trauma injury.

MOMRP researchers are using large animal injury studies with advanced mathematical modeling and medical imaging techniques to develop a biomedically valid body armor blunt trauma test method. The method will include a cost-effective body armor testing device that measures and characterizes forces behind the armor, and a software application that uses a valid human injury prediction model to translate the measured forces into predictions of human injury. The testing method will enable development and fielding of lighter and more comfortable body armor systems that confidently protect Soldiers from penetrating and blunt trauma injuries.

Laboratory/Developer

Tital Corporation
University of California, San Diego

Design Guidelines for Head-Supported Devices (HSDs)

Mission

Developing HSDs requires design guidelines and health hazard assessment methods to enhance Soldier performance and provide protection from neck injury.

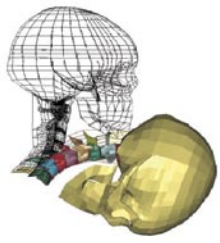
Description

Biomedically based design guidelines and assessment methods for HSDs, such as protective helmets, weapon-sighting, and communication systems, are being developed. The development process will use epidemiological studies, biomechanics, injury studies with human cadavers and mannequins, and advanced biofidelic neck models to develop and validate neck injury criteria. The health risk assessment method includes the neck injury prediction model and algorithms that produce a risk assessment code based on the predicted injury severity and the probability of occurrence.

HSDs are critical components; however, they increase the amount of weight supported by the head and neck and may place Soldiers at risk of degraded performance or neck injury. This project will provide guidelines and assessment methods for the development of safe and effective HSDs, including the Future Force Warrior (FFW) helmet design.

Laboratory/Developer

U.S. Army Aeromedical Research Laboratory (USAARL)



Injury Prevention and Restraint Technologies for Ground Vehicles and Helicopters

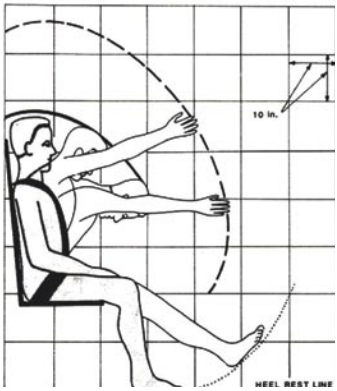
(Conventional Restraint Systems)

Mission

Develop biomedically based injury criteria and test methods for improved helicopter and ground vehicle occupant protection systems. Provide system developers with the tools they need to design, develop, and field safer and more survivable air and ground vehicles for Soldiers.

Description

Many injuries that routinely occur in tactical vehicle operations and crashes are preventable through the use of improved occupant restraint systems. Traditionally, military ground vehicles have not been equipped with state-of-the-art safety equipment, but significant improvement in occupant safety in tracked and wheeled tactical vehicles can be realized through the integration of commercial automotive technology and current military aviation restraint systems. Contact injuries account for over 80% of the injuries received in Army vehicle crashes. Biomedically based performance criteria and flail trajectories are needed during the design and development of occupant restraint systems. New generic test methods are being developed to ease comparative performance assessments among candidate restraint systems. Special considerations in the military vehicle environment include the need for urgent and unencumbered egress following enemy contact.



Laboratory/Developer

USAARL

Product Status: **PROMISING** ◆ FUTURE ◆ COMPLETED

Subcategory: ***Injury Biodynamics***

Injury Prevention and Restraint Technologies for Ground Vehicles and Helicopters (Inflatable Restraint Systems)

Mission

Develop biomedically based design guidelines for improved helicopter and ground vehicle occupant protection systems. Provide system developers with the information and tools they need to design, develop, and field safer and more survivable air and ground vehicles for Soldiers.

Description

Inflatable restraint technologies are being developed and integrated into Army aviation platforms. While these technologies have inherent crash protection capabilities, they also introduce new and novel injury hazards. USAMRMC testing revealed hazards to the upper extremities and ocular regions when the systems are not properly designed or the occupant is not in the design eye position. The prototype lateral bag design was found to present a greater than 90% risk of upper extremity injury, prompting a system redesign. The redesign eliminated 99% of the hazard. Over 300 UH-60L helicopters have been modified with the air bag system. Surveillance of injury resulting from crashes of these air-bag-equipped vehicles is ongoing and will reveal the injury mitigation capabilities and new hazards associated with these protective systems. Expanded research and modeling efforts will provide guidelines to assist in the design of future inflatable restraint systems that reduce the risk of these inherent hazards.

Laboratory/Developer

USAARL

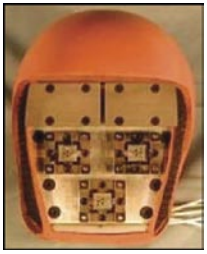
Warfighter Face and Eye Injury Protection

Mission

Provide Army materiel developers with an efficient, cost-effective means of assessing novel face and eye injury hazards, as well as the effectiveness of protection strategies.

Description

In recent conflicts, combat injuries to the head and neck outnumber torso injuries by nearly 4 to 1, reversing the historical trend. The most frequently injured regions of the warfighter's head and neck are the eyes and orbit, causing significant morbidity and mortality. Although combat helmets provide substantial cranial protection against penetrating trauma, the face and eyes are left exposed to shrapnel and other ballistic projectiles. Blunt injury to the face and eyes is an increasing problem as well due to the growing use of helmet-mounted displays (HMDs) by mounted and dismounted Soldiers. Previous research has documented the risk of severe blunt injury in vehicular crashes as well as minor injury from tripping or falling when wearing HMDs.



Operationally focused face and eye injury research conducted under the USAARL Cockpit Air Bag research program illustrated the need for biomedically relevant facial and ocular injury criteria, as well as a timely, low-cost alternative to cadaver-based testing. The primary research thrusts in this program include the development of a biofidelic test mannequin capable of measuring blunt impact forces acting on the face and eye and the promulgation of biomedically based facial and ocular injury criteria. Together, these tools will allow Army materiel developers an efficient, cost-effective means of evaluating the efficacy of novel face and eye protection devices. This research effort will lead to improved protective devices, enhancing the survivability and sustainability of the FFW.

Laboratory/Developer

USAARL

Pre/Post-Deployment Psychological Screening

Mission

Improve Soldier and unit functioning through early identification of Soldiers with potential behavioral health problems using a simple, easily administered, valid, and cost-effective screening procedure.

Description

Prior to and returning from deployments, mental health providers are often tasked with identifying Soldiers who might benefit from behavioral health services. Through the use of survey instruments and brief structured clinical interviews, large groups of Soldiers can be rapidly screened, and those with potential behavioral health care issues can be identified and referred for follow-up care.

In 2004, blind-validation screening studies produced a short screen fielded in U.S. Army Europe. The research also demonstrated that mental health concerns become more evident several months following return from combat. This screening research program influenced the development of policy, directed by the Assistant Secretary of Defense for Health Affairs, to conduct a mental health assessment of service members 3 to 6 months post-deployment.

By establishing a short and valid screening procedure and determining the optimal time to conduct screening, mental health support can be streamlined and can bring mental health services forward to meet the needs of a deploying force.

Laboratory/Developer

U.S. Army Medical Research Unit-Europe (USAMRU-E)
Walter Reed Army Institute of Research (WRAIR)

Soldier and Military Family Behavioral Health

Mission

Improve the behavioral health care of Soldiers and their families by utilizing scientific survey methodologies to measure the effects of deployments and combat on the behavioral health of Soldiers and their families.

Description

Over 17% of the Soldiers screen positive for a mental health problem (anxiety, depression, or post-traumatic stress disorder) up to 6 months after returning from a combat deployment. Further, nearly 10% of active-duty spouses met screening criteria for a mental health problem. By accurately measuring and better understanding the factors involved in Soldier and family mental health problems, mitigating policies and programs can be developed to improve Soldier and family behavioral health care.

Early results of these efforts include the Deployment Cycle System in which Soldiers are placed on a half-day schedule with classes on reintegration for a week or more to provide a monitored and gradual readjustment to home and family. Also, significant changes have been made in Combat and Operational Stress Control doctrine and procedures related to behavioral health care delivery on the battlefield. These include (1) educating Soldiers and leaders about behavioral health care, (2) emphasizing the role of leaders at all levels in supporting access to behavioral health care, (3) integrating behavioral health services in primary care clinics for Soldiers and spouses, (4) organically attaching behavioral health care personnel to battalion-level Family Readiness Groups, and (5) improving the support of activated reserve component Soldiers and their families.

Laboratory/Developer

WRAIR

Design Guidelines for Auditory Displays

Mission

The MOMRP's auditory performance research program is developing biomedically based design guidelines for auditory displays to ensure their effective use by all Army aviators and Soldiers, regardless of their hearing profile or the noise level in the operational environment.

Description

New auditory display technologies, such as 3-D auditory displays, have not been tested in populations with hearing loss or in noisy environments typical of rotary-wing aircraft and tactical vehicles. If Soldiers do not correctly perceive these auditory displays, weapon system safety may be compromised and weapon system effectiveness may be diminished.

Research couples advanced analytical and engineering techniques, such as dichotic speech analysis and virtual display engineering, with an understanding of how the brain processes spatial auditory cues and compensates for hearing impairment. Products of this research will include novel testing methods and performance criteria for auditory display technologies that enhance Soldier safety and operational performance.

Laboratory/Developer

USAARL

Biological Markers (Biomarkers) of Toxic Exposures and Effects for Deployment Health Surveillance

Mission

An increasingly important aspect of Force Health Protection is operational risk management of toxic and hazardous chemical exposure during deployments. Troops may be exposed to harmful chemicals as a result of accidents, sabotage, hostile military action, or environmental pollution. New risk assessment methods and tools are needed for managing these risks and for conducting health surveillance of military personnel.

Description

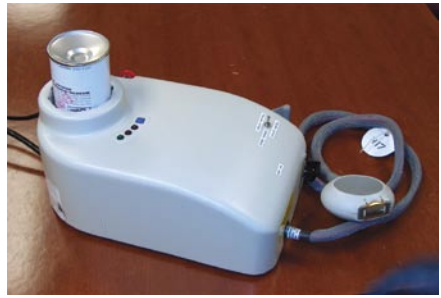
Biological markers, or biomarkers, are measurable molecular, biochemical, or cellular alterations in biological matrices (such as fluids, cells, or tissues) that occur in response to hazardous chemical exposure. Since biomarkers can indicate the degree of exposure, biological effects, and susceptibility to disease from hazards that personnel may encounter, they have many potential applications in Force Health Protection and health surveillance of DoD personnel.

This research program is identifying key biomarkers associated with hazardous chemicals encountered by military personnel. Taking advantage of genomic technologies and bioinformatics, experiments are being conducted using genome-sequenced animal models to identify novel biomarkers that are also highly conserved (homologous) in humans. Along with microarrays for gene expression, a proteomics approach (analysis of an organism's proteins, or its proteome) is also being used to screen for biomarkers. The products of this effort include validated and measurable sets of biomarkers that can be used to evaluate the toxic exposures encountered by military personnel.

Laboratory/Developer

U.S. Army Center for Environmental Health Research (USACEHR)

Light-Based Self-Treatment System for Pseudofolliculitis Barbae (PFB)

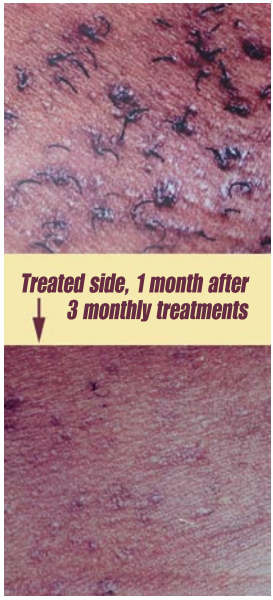


Mission

PFB (or shaving bumps) is an inflammatory condition diagnosed in dark skinned men with thick, coarse hair who shave regularly. This condition currently has no permanent definitive treatment and significantly compromises a Soldier's ability to wear close-fitting protective facial gear such as the Mission-Oriented Protective Posture head mask. The goal of this effort is to develop a lightweight self-operated and portable device for treatment of PFB.

Description

Currently available depilatories, topical creams, and "PFB razors" do not offer a definitive answer for PFB and, at best, only temporarily ameliorate the condition. PFB can impact force readiness and affects the Soldier's quality of life. More than 50% of African American servicemen have this condition. This project is developing a self-operated, portable, low irradiance PFB treatment device that can be used by individuals without physician supervision. Current protocols are in clinical trials with prototypic larger units operated by a physician; further trials are planned for smaller units using self-treatment parameters.



Laboratory/Developer

Congressionally Directed Medical Research Programs
Palomar Medical Technologies, Inc.

Biomedical Guidance for Optimization of Lightweight, Restricted-Energy Rations

Mission

Random selection ("field stripping") of components from Meals, Ready-to-Eat (MREs) by Soldiers attempting to reduce the weight and volume of food to be carried is likely to result in suboptimal Soldier performance. To remedy such shortfalls, new lightweight individual assault rations are in development, but design factors constrain nutritional energy content. Developers require new biomedical research information to optimize nutrient content and maximize nutrient bioavailability.

Description

Biomedical experiments and modeling will help determine energy and specific nutrient cost of FFW missions and identify nutritional strategies to better sustain FFW cognitive and physical performance during periods of energy deficit and heavy work. Novel nutrient delivery systems, food formulations, and feeding plans incorporating eat-on-the-move ration components, evaluated in laboratory and field tests, will improve on-demand bioavailability of specific, performance-sensitive nutrients during FFW missions. This will assist the ration developer in leveraging the science and technology information derived from these biomedical studies against parallel advances in emerging food science and packaging technology and in fielding a family of solutions that improve overall energy and nutrient intake by FFW and enhance performance sustainment, while reducing ration weight, source material, and discarded food.

Laboratory/Developer

USARIEM

Design Guidelines for Effective Microclimate Cooling (MCC) Systems

Mission

Improvements in the design and implementation of MCC systems will enhance Soldier performance and reduce both heat strain and injury.

Description

The efficacy of MCC systems will improve through the implementation of physiologically driven designs. Engineering attempts to enhance liquid MCC capabilities include reducing the coolant temperature and increasing flow, both of which increase power requirements. However, from a physiological perspective, these approaches may be self-defeating. Skin cooling produces skin vasoconstriction, increases thermal resistance, and decreases conductive heat transfer. This project examines the use of intermittent microclimate cooling (IMCC) to reduce vasoconstriction, maximize heat flux, and conserve battery power requirements.

Future Force operational requirements will accentuate heat strain, increase the incidence of heat casualties, and reduce work performance by demanding sustained work rates and rapid deployment with minimal time for acclimatization. Traditional MCC technologies have been successfully used to alleviate heat strain in mounted Soldiers, but cooling limitations and power and weight restrictions do not currently make this technology applicable to dismounted Soldiers.

This project will maintain performance capabilities of the Soldier by improving heat flux, thus reducing heat strain and water requirements. IMCC will also decrease power requirements by 45%.

Laboratory/Developer

USARIEM

Effective Army Weight Management Strategies

Mission

The Army weight control program is intended to prevent obesity and optimize combat readiness of Soldiers through motivation of good fitness and nutrition habits.

Description

Biomedical research is being conducted to identify components of effective weight loss programs for Soldiers exceeding body fat standards. Effectiveness of the currently enforced standards and program is being compared to best practices in the civilian community, and these approaches are being evaluated for suitability in the unique military environment. Factors governing success in weight maintenance through a military career are being evaluated. Studies of the importance of relative fat and protein content of diets will contribute to garrison and field feeding guidance. Candidate weight loss program strategies include meal replacement diets by military personnel, subsistence on structured energy-restricted meals served in garrison dining facilities, and Internet or PDA-based weight loss/maintenance interventions applicable to Army Reserve and National Guard personnel as well as active duty.

Laboratory/Developer

Pennington Biomedical Research Center
USARIEM

High-Altitude Warfighter Readiness Strategies

Mission

New products and strategies will mitigate the effects of high altitudes on warfighter readiness and performance and increase deployability to these areas.

Description

The Future Force must be able to rapidly deploy and effectively fight in any environment, including high-altitude environments; however, rapid deployment of unacclimatized troops to high altitudes can cause debilitating effects on performance and health. Current acclimatization techniques can take 6-14 days of continuous exposure to high altitudes, and available medications that reduce Acute Mountain Sickness (AMS) also impair work performance and have other adverse effects. Advances in the understanding of altitude acclimatization and AMS pathophysiology will help develop strategies to protect and sustain warfighter performance and decrease AMS susceptibility during rapid deployments to altitude. The deployability, readiness, and sustainability of operations under high-altitude conditions will increase with the products from this effort. These research products will include performance-enhancing nutritional supplements for high-altitude rations, procedures to induce and time compress altitude acclimatization prior to deployment, prediction models of military work performance and altitude illness, and a decision aid to plan and manage unit task performance, altitude illness, and logistical needs.

Laboratory/Developer

USARIEM

Pathology of Heat and Cold Injury

Mission

Rapid deployment and sustained operations of the warfighter at thermal extremes can compromise performance, prevent mission goals, and increase non-combat casualties. Prevention of non-combat casualties can only be realized with knowledge base enhancement of the complex mechanisms that mediate thermal injury.

Description

The development of animal and cellular models of heat injury permit the study of militarily relevant issues associated with environmental extremes under extreme thermal conditions that are too dangerous to study in human volunteers. Elucidation of the mechanisms of thermal injury will lead to novel strategies that enhance warfighter capacity to sustain performance and health in hot and cold environments.

Laboratory/Developer

USARIEM

Sleep Watch

Mission

The Sleep Watch noninvasively measures Soldier sleep and predicts Soldier performance. When integrated into the Warfighter Physiological Status Monitor (WPSM) and FFW, it will provide commanders with online, real-time predictions of cognitive readiness and enable effective management of sleep to sustain operational performance.

Description

The Sleep Watch Actigraph is a wrist-worn (wear-and-forget) digital signal-processing device that provides real-time quantitative estimates of individual performance capacity (cognitive readiness) based on sleep/wake history derived from wrist movements. The Sleep Watch generates performance estimates from the built-in Fatigue Intervention and Recovery Model (FIRM). These estimates are available to the individual Soldier on the face of the Sleep Watch and can be telemetered to commanders, providing commanders with individual performance estimates for purposes of mission planning using the Fatigue Performance Prediction Tool (FPPT).

An application-specific integrated circuit for micro-electro-mechanical system activity sensor, the built-in sleep-scoring algorithm, and the FIRM form an "intelligent sensor" that will be integrated into the WPSM and FFW and other future Soldier systems. Additional sensors are monitoring for field (life signs, vital signs, and live/dead estimation) and clinical (shivering and tremor) applications.

The Sleep Watch integrated into the WPSM and associated telemetry systems provides remote monitoring capabilities needed to predict Soldier performance at a low cost in terms of power, weight, volume, and computational capacity.

Laboratory/Developer

WRAIR

Strategies to Optimize Bone Health and Eliminate Stress Fractures in New Recruits

Mission

Stress fracture of the lower extremities is a common and potentially debilitating overuse injury and is one of the major contributors to lost training time for new recruits. The rise in disability discharge rates is primarily attributed to bone and joint problems. The way we feed, train, and treat young men and women entering the military can play a significant role in decreasing risk for stress fracture in the short term and osteoporosis and other bone diseases, such as osteoarthritis, in the long term.

Description

Current research, supported, in part, through special congressional funding, includes nearly 40 major studies centered around physical training and other factors that influence the normal bone remodeling and repair process. In addition to identification of modifiable risk factors for stress fractures that result from changes in physical training load, these studies seek to identify interventions that might improve bone quality through biomechanical forces (including vibration and exercise), nutrition (including protein, vitamin D, and calcium intake), and hormonal influences (including low-dose estrogens, DHEA, and androgens). Combined with the results of additional studies investigating the role of genetics and personal health, dietary, and fitness habits, this bone health research program will lead to innovative approaches to prevent stress fracture injury in new recruits, provide early diagnosis and treatment of stress fractures, and favorably affect disability discharge rates. The ultimate goal of this program is to eliminate stress fracture injuries, improve overall bone health of the warfighter, and ensure continued quality of life beyond the Soldier's military career.

Laboratory/Developer

USARIEM

Warfighter Physiological Status Monitoring (WPSM–Initial Capability)

Mission

The WPSM system enables remote situational awareness information to be sent to both commanders and medics. The system will provide timely health monitoring, detection of events (ballistic or warfighter initiated), and basic triage information remotely.

Description

The WPSM system is a tailorable suite of medical and monitoring devices that in total weigh less than 16 ounces. The baseline system will consist of the following monitoring devices: life sign detection sensor (measured parameters: heart rate, respiration rate, body orientation, actigraphy, and skin temperature), ballistic impact detection sensor, fluid intake monitor, sleep/performance watch, and core temperature pill (used as indicated by a medic or operational environment).

Information from the monitoring devices is transmitted over a low-power personal area network to a medical hub. The hub provides both storage for medical records (personal information carrier) and interfaces to a number of off-body warfighter communication channels. Physiologic and medical algorithms, running on the hub, provide indicators of the following states: life signs, thermal, hydration, and sleep/performance. The hub also tracks events such as the warfighter-activated medic call button (911 button) or sensor-detected ballistic impacts. State and event information is forwarded via warfighter radio to medics or commanders.

Laboratory/Developer

USARIEM
U.S. Army Institute of Surgical Research (USAISR)
WRAIR

Biomechanical Design Guidelines for Personal Equipment

Mission

Biomechanics, as applied to the military, is the process of analyzing Soldier physical activity and equipment from the point of view of physics and mechanical engineering. The goal is to improve military equipment and training to enhance Soldier effectiveness and reduce injuries. A state-of-the art biomechanics laboratory, including a high-speed multi-camera video motion analysis system, a custom-built dual-force platform treadmill (patent pending), a custom-built force-sensing backpack, in-shoe force sensors, and a telemetry system for monitoring muscle electrical activity, is used to analyze Soldier physical activity and equipment.

Description

Biomechanical analyses involving load carriage are made in conjunction with the determination of metabolic rate or energy cost. This includes evaluation of prototype military load carriage systems and footwear to assist in making equipment development and procurement decisions. Physical training programs are being evaluated for improving Soldier physical performance and quantification of the effects of load carried on the speed of overground foot travel and the negotiation of obstacles on the battlefield.

Laboratory/Developer

USARIEM

Physical Training and Injury Prevention Monitoring Strategies for Improved Military Task Performance

Mission

In addition to physical preparedness, appropriate physical training combined with careful monitoring of training status has the potential to reduce the incidence of occupational injuries as well as injuries due to physical training.

Description

The high physical demands of Army military occupational specialties (MOSs) combined with the lack of emphasis on strength training often result in a physical mismatch between the Soldier and the MOS. To decrease this physical disparity and improve Soldier performance, laboratory studies will be used to demonstrate the effectiveness of new biomechanics- and physiology-based physical training programs. Recommendations have been developed to control the quantity and speed of running training during Basic Combat Training, and studies are investigating specific effects of training programs to improve load carriage performance.

Physical training programs can be objectively evaluated in terms of improvements in basic physical capacities or in terms of physical performance tests; however, the translation of improvement on these measures into improvement in Soldier performance is not well defined. A battery of militarily relevant, common-soldiering tasks are being developed that will provide greater insight into the benefits of physical training programs.

Laboratory/Developer

USARIEM

Subcategory: *Neuropsychology*

Early Interventions Following Exposure to Potentially Traumatic Events

Mission

Optimize the health and functioning of Soldiers and their units exposed to potentially traumatic events using evidence-based early interventions.

Description

Military personnel are at risk for exposure to an array of potentially traumatic events. Such exposure is associated with increased risk for the development of psychiatric disorders such as acute stress disorder and post-traumatic stress disorder as well as other psychological problems. These significant mental health problems can reduce Soldier and unit functioning and may affect a Soldier after his or her military career.

Although some early intervention techniques exist (psychological debriefing, for example), there are no controlled studies examining the impact of existing early interventions on the health of military personnel. Research efforts are now under way to test one of the more popular techniques currently used on the battlefield, Critical-Incident Stress Debriefing (CISD) – a group-based approach for systematically reviewing cognitive and emotional reactions to potentially traumatic events. A second type of intervention using writing about combat-related experiences is also being tested to determine its efficacy for use with military personnel exposed to potentially traumatizing events. By empirically testing the efficacy of CISD and other techniques, optimal and critically needed early interventions can be developed and fielded to decrease or mitigate the impact of trauma on Soldiers.

Laboratory/ Developer

USAMRU-E
WRAIR

Fatigue and Performance Models

- ♦ Fatigue Intervention and Recovery Model
- ♦ Fatigue Performance Prediction Tool

Mission

Mission planners require tools to (1) estimate degradation in Soldier effectiveness during continuous or sustained operations, (2) estimate the degree to which countermeasures (naps and stimulants) restore/sustain performance, and (3) plan and optimize individual and unit work/sleep scheduling in real time.

Description

The FIRM predicts cognitive readiness for particular tasks or categories of tasks based on those factors accounting for the greatest amounts of variability in cognitive performance: (1) sleep/wake history, (2) mental workload, (3) time on task (fatigue), (4) individual difference factors, and (5) pharmacological countermeasures. The FIRM is integrated into both the FPPT (for mission planning) and the Sleep Watch and is a component of the WPSM and FFW.

The FPPT is a flexible, laptop-based software program that allows for (1) prospective forecasting of cognitive performance based on any hypothetical sleep/wake schedule; (2) when needed, the real-time optimization of personnel work/sleep scheduling; and (3) reconstruction of probable cognitive performance level based on a known (or estimated) sleep/wake schedule associated with an event (e.g., accident reconstruction).

Laboratory/Developer

WRAIR

Subcategory: Neuropsychology

Guidance on Using Modafinil, Dextroamphetamine, or Other Controlled Substances

Mission

Guidelines are needed regarding the use of controlled pharmacologic products to enhance performance and alertness during continuous and/or sustained operations.

Description

Research is under way addressing the use of controlled (prescription-only) pharmacologic products to enhance performance and alertness during unavoidable sleep loss. Two prescription-only stimulants are currently being tested: dextroamphetamine (Dexedrine®) and modafinil (Provigil®). Issues addressed include (1) comparative performance among products during extended sleep loss (particularly for restoring planning, decision making, and situational awareness); (2) duration of effect across different dosing levels; (3) potential development of tolerance to product effects; and (4) operationally relevant side effects to include potential impairment of recovery sleep. Of specific interest is whether these products offer any advantages over caffeine, a readily available over-the-counter stimulant that is safe and effective.

Information regarding modafinil's performance-sustaining and side-effect profile during extended sleep loss is lacking – this information is needed to determine whether an FDA license should be sought for a military indication to administer modafinil to sustain performance and alertness for a period of 72 hours or greater.

Laboratory/ Developer

USAARL
WRAIR

PDA-Based Psychomotor Vigilance Task (PVT)

Mission

Determine cognitive readiness levels of sleep-restricted/deprived Soldiers in the field with the PVT. Knowing each Soldier's cognitive readiness level will allow commanders to plan intelligently for the re-supply of adequate sleep to sustain performance and personnel recycling over the life of the mission.

Description

The PVT is a simple psychomotor response task run on a PDA that provides the capability to reliably assess cognitive functioning and alertness of individual Soldiers in the operational environment. The PVT can be used to gauge the extent of cognitive restoration following short sleep opportunities and/or stimulant administration. Laboratory and field studies show that the PVT is the most sensitive and reliable metric for detecting and quantifying impairments due to even mild amounts of sleep restriction – and in advance of frank errors and accidents. PVT output can be input to the FIRM to individualize the model to yield highly accurate, real-time individual performance status predictions. Future work will link PVT metrics to cognitive abilities affecting situational awareness and the capacity for rapid, correct decision making that enables the Soldier to recognize and capitalize upon emergent battlefield opportunities.

Laboratory/Developer

WRAIR

Psychological Readiness in a Deployed Environment (PRIDE)

Mission

Improve Soldier, family, and leader psychological coping and adaptation to deployment and combat conditions through pre-deployment education and intervention.

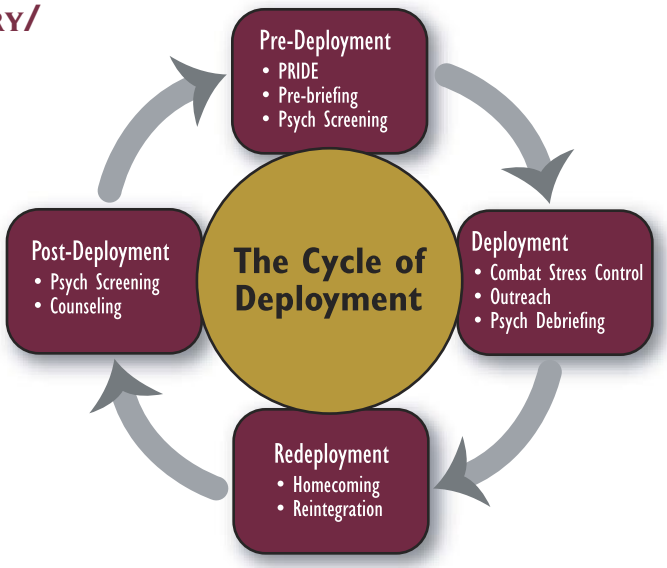
Description

Deployment and combat can stress both Soldiers in the field and families at home. Deprivation and fatigue occur in all deployments; combat can add anxiety, fear, horror, loss, and occasionally guilt and shame. These psychological issues may lead to poor performance, impaired leadership, disruption of unit cohesion, misconduct, and family problems.

Psycho-educational training, psychological "pre-briefing," and other early interventions will mitigate risk and build Soldier, leader, and family resiliency. These pre-deployment interventions provide critical components of a "wrap-around" preventive behavioral health care system for Soldiers and families during the cycle of deployment.

Laboratory/ Developer

WRAIR



Unit Behavioral Health Needs Assessment

Mission

Improve Soldier and unit functioning by devising an assessment methodology and survey tool for commanders to measure and classify the behavioral health needs of their Soldiers.

Description

As Army behavioral health care transforms from a stationary, reactive, tertiary care system to an outreach, proactive, primary prevention system, new tools and techniques are needed for both assessment and intervention. Unlike traditional methodologies used in provider-patient assessment, diagnosis, and treatment, unit-based primary prevention requires unit needs assessment, command consultation, and population intervention methodologies.

Utilizing field-deployable needs assessment technologies and with assistance from behavioral health care personnel, commanders will be able to accurately assess the level of behavioral dysfunction in a unit, identify barriers to care, and develop unit-unique behavioral health interventions to improve Soldier and unit functioning. These technologies will be applicable in war and peace, in garrison, and in the field.

Laboratory/Developer

USAMRU-E
WRAIR

Warfighter Physiological Status Monitoring–Commander (WPSM–Commander)

Mission

Sensor technologies exist today that can provide information on mental status (e.g., cognitive, psychomotor, mood, and anxiety) of Soldiers. This is critical intelligence on Soldiers operating in situations that are difficult to monitor, including remote areas away from other team members, encapsulation in chemical protective equipment, and low visibility operations. Algorithms are needed to provide useful knowledge about Soldier mental status on the basis of sensor signals, individual history, and environmental conditions.

Description

Improvements to current WPSM concepts (WPSM–Initial Capability) call for an expansion to more difficult predictions of physiological states that are still within the normal range of clinical parameters such as extreme fatigue and early neurochemical threats. The WPSM–Commander will provide information on fitness for duty and real-time probabilities of judgement/decision-making impairments. Predictive algorithms will be based on empirical studies using current technologies such as unobtrusive measures of brain blood flow, pupil responses, changes in voice fundamental frequency, recent cardiac parameters, energy balance, tissue glucose levels, and electroencephalography. Combinations of these measures will be compared against militarily relevant psychological outcomes in studies in stressful environments. The product will be specifications for a minimum sensor set and algorithms that provide information that a commander wants to have on individual Soldier status during performance-critical missions.

Laboratory/Developer

USARIEM

Subcategory: *Psychophysics*

Laser Eye Injury Field Therapy Kit

Mission

Develop a field therapy kit for the treatment of laser-induced eye injury.

Description

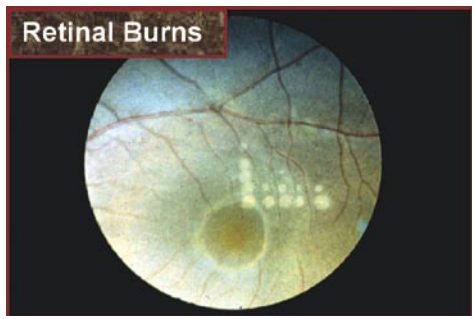
The Laser Eye Injury Field Therapy Kit will contain comprehensive diagnostic tools and genomic- and proteomic-derived drug treatment strategies for laser-induced eye injury. The human eye is extremely vulnerable to the directed energy from military lasers. Laser eye exposures can result in immediate visual impairment or blindness. The Field Therapy Kit will provide the combat medic with the tools to rapidly diagnose and treat laser eye injuries to minimize vision loss.

Current research is evaluating laser-induced retinal injury mechanisms at the cellular level and utilizing genomic and proteomic assays to minimize primary and secondary injury mechanisms. Advanced diagnostics are being assessed to measure function and characterize primary and secondary (or longer term) effects from highly localized thermal and/or thermal-mechanical injury.

Depending on the taxonomy of the injury (laser dose, location within the retina, etc.), primary and secondary effects include retinal burn, retinal and vitreous hemorrhage, retinal hole formation, interretinal scar formation, choroidal neovascularization, retinal nerve fiber degeneration remote from the lesion site, and retinal traction. These diagnostics, coupled with the pharmacological and surgical interventions recommended or provided by the Eye Injury Field Therapy Kit, will minimize the visual impairment from laser-induced injury.

Laboratory/ Developer

U.S. Army Medical Research Detachment (USAMRD)
WRAIR



Environmental Sentinel Biomonitor (ESB) System

Mission

Provide rapid toxicity identification for a broad spectrum of toxic industrial chemicals in water in a field-portable device.

Description

Providing drinking water to deployed troops can utilize a large fraction of available transportation assets. Although decentralized water production could reduce the transportation burden, it will be difficult to ensure that water produced in many diverse locations is safe to drink in view of the many toxic industrial contaminants that may be present in water and the limited number of such chemicals that can be identified rapidly in the field.

Evaluating the overall toxicity of a water sample provides an alternative to the identification of a large number of individual chemicals. Cell- and tissue-based toxicity sensors are available that integrate biological systems with electronic monitoring, facilitating a rapid response to toxic chemicals. The ESB system will integrate information from these miniature toxicity sensors to provide a rapid evaluation of drinking water quality.

Potential ESB system applications include water treatment plants, field water production facilities that use equipment including the Tactical Water Purification System, Future Combat Systems manned ground vehicles to evaluate water produced by on-board water generation equipment, and use by individual Soldiers in the field (e.g., Special Forces).

Laboratory/Developer

USACEHR

Health Risk Communication Strategies for New Recruits

Mission

Young men and women enter the Army with a diverse health educational background. Alcohol abuse, tobacco use, unintended pregnancy, acquisition of sexually transmitted diseases (STDs), and sexual violence/harassment are significant but modifiable risks that have important impacts on individual and unit readiness.

Description

Biobehavioral programs to reduce health-damaging behaviors are being developed and tested for use in populations in initial entry training. These are based on health risk communication research and other psychosocial approaches to effectively reach young men and women. In a randomized controlled trial, one program designed for the military reduced the rates of STD infection by greater than 30% and reduced unintended pregnancy in a vulnerable population of female Marines up to 18 months after their initial entry training. A new program is being developed to explore the effectiveness of mixed gender training on interrelated health risks including alcohol abuse, STDs, unintended pregnancy, and sexual violence. The product of this research will be proven methods to effectively communicate with young service members on personal health risk behaviors.

Laboratory/Developer

Department of Adolescent Medicine, University of California, San Francisco

USARIEM – Fort Bragg Medical Research Unit

Health Risk Surveillance Tools – Neurocognitive Assessment

Mission

Following the Gulf War, it became evident that the DoD lacked routine test methods to determine changes in neuropsychological status of Soldiers resulting from occupational or environmental exposures. Surveillance methods are essential to early detection of neurocognitive changes that indicate near-term threats to Soldier performance and long-term health risks, including neurodegenerative diseases.

Description

Research is currently under way to understand the potential neurocognitive health and performance risks associated with deployment operations and military service in general. This includes prospective epidemiological field studies of Soldiers deploying to Bosnia and Iraq. Current and planned research also focuses on identification of practical and valid bioindicators of neurotoxic exposures, effective doses and utilization of appropriate test batteries for field assessment of neurocognitive changes in military personnel over time. The products of this research will be valid, reliable, field-tested methods that can be integrated into epidemiological study designs for real-world, real-time assessment of neurocognitive health and performance with potential occupational and environmental chemical exposures.

Laboratory/Developer

Boston University School of Public Health
Department of Veterans Affairs
USARIEM

Rapid Analysis of Water for Microbial Contamination

Mission

Provide rapid identification and semi-quantification of *Escherichia coli* and total coliform bacteria in 8 hours or less instead of the current 18-24 hours.

Description

The assurance of safe water is paramount to the health and the performance of the warfighter. Any technology to assess the microbial purity of water under field conditions must meet rigorous criteria: It must be readily portable, provide timely results, have adequate sensitivity (1 colony forming unit per 100 milliliters), be compatible with military power sources, and be of a complexity appropriate for operation by a preventive medicine specialist (91S).

Pacific Technologies developed the "Coliform Analyzer" that combines classical membrane filtration with innovative computer/electronics for the selective growth and semi-quantification of both total coliform bacteria and *E. coli* in the presence of other water heterotrophic bacteria.

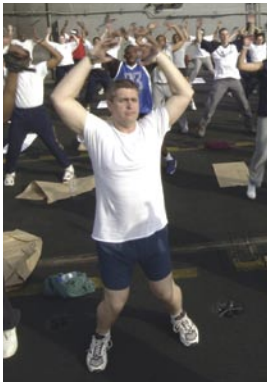
Pacific Technologies has been awarded another contract to continue development and commercialize the "Coliform Analyzer" with the purpose that this detector will replace the coliform tests currently used by the Army.

Laboratory/Developer

Pacific Technologies
USACEHR

Cold Exposure Guidelines

- Policy memoranda, field manuals, and training aids regarding hypothermia and other cold injuries were produced in conjunction with U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) and the Office of the Surgeon General. Examples include "Sustaining Health and Performance in Cold Weather Operations" and the training aids "Cold Weather Casualties and Injuries Chart" and "Avoid Cold Casualties."
- Provides state-of-the-art guidelines for training and operational practice that serve to prevent and/or reduce cold-related injury to Soldiers.
- A comprehensive Technical Bulletin guidance document for health care providers entitled "Cold Stress Control and Cold Casualty Management" (TB MED 508) is currently in press.

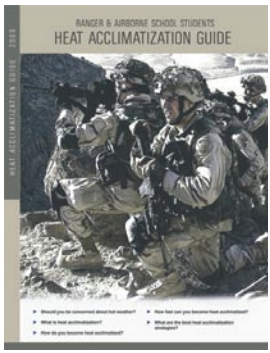


DoD Body Fat Assessment Methods and Standards

- A reconciliation of Service differences in body fat measurement methods, screening weights, and body fat standards to yield a single set of assessment methods and standards that were incorporated into DoD Instruction 1308.3, "DoD Physical Fitness and Body Fat Programs Procedures."
- Prevention of obesity in the military will lead to increased combat readiness of Soldiers.

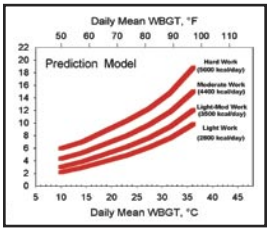
Environmental Strain Prediction Models

- Biomedically valid tools for predicting individual and unit-level performance outcomes based on environmental and operational variables. Given particular terrain characteristics, environmental temperature, and clothing requirements, these tools will provide accurate predictions of thermal strain with recommendations for fluid replacement and work/rest schedules.
- Provides mission planners/leaders the ability to simulate missions using accurate predictions regarding Soldier performance in environmental extremes.



Heat Exposure Guidelines

- Policy memoranda, field manuals, and training aids regarding heat injury were produced in conjunction with USACHPPM and the Training and Doctrine Command (TRADOC) Surgeon's Office. Examples include Heat Injury Protection Guide, the Heat Acclimatization Guide, and the Technical Bulletin guidance document for health care providers entitled "Heat Stress Control and Heat Casualty Management" (TB MED 507).
- Provides state-of-the-art guidelines for training and operational practice that serve to prevent and/or reduce heat-related injury to Soldiers.



Hydration Monitor

- An extension of the model used to predict sweat rates of Soldiers during operational stress. High work rates, extended durations, and clothing/equipment (applicable to Future Force operations) are incorporated in the extended algorithm.
- Provides greater precision in estimating Soldier water needs that enhances safety and sustainability of the Soldier and improves the efficiency of water re-supply.

Performance Enhancing Ration Components

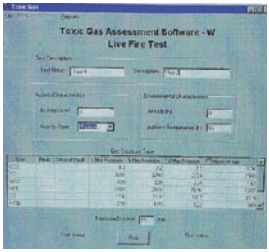
- Carbohydrates are added to rations for the purpose of enhancing Soldier physical and mental endurance. Examples are the Hooah® bar and the Ergo® drink.
- Offsets fatigue and stress effects on performance.

Evaluation of Human Exposure to Whole-Body Vibration: Method for Evaluation of Vibration Containing Multiple Shocks

- Standardized method for health hazard assessment of whole-body vibration and repeated jolt in Army tactical ground vehicles, based on laboratory studies of human responses to repeated jolts and a neural network of the lower spine. Published as an international standard (ISO 2631-5) and transitioned to the USACHPPM.
- Allows for the prediction of potential injuries to Soldiers from riding in tactical ground vehicles, particularly at high speeds over rough terrain.

INJURY

- A tool for predicting lung injury from exposure to blast overpressure (BOP) from high-powered weapon systems. Uses BOP data from weapon system tests, extensive large animal BOP exposure studies, and advanced biomechanical modeling techniques to estimate the probability and severity of lung injury.
- Enables Army Health Hazard Assessment and Soldier Survivability Programs to predict the nature and extent of injuries and provides weapons system developers with information necessary to develop safer and more survivable weapon system designs.



Toxic Gas Assessment Software (TGAS)

- A tool for predicting incapacitation and injury due to inhalation of toxic gases by Soldiers behind defeated armor. Based on toxic gas concentration data from live-fire tests, small animal toxic gas exposure studies, and advanced systemic and biomechanical modeling techniques.
- Provides weapon systems developers with information for developing a more survivable weapon system.

AMEDD Suicide Event Report (ASER)

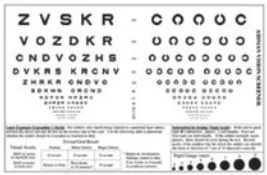
- A reporting instrument (with both quantitative and qualitative information) to better understand and summarize suicides in real time that uses a web-based electronic data system containing information on all completed suicides and on all hospitalized attempted suicides.
- Enhanced Army suicide surveillance will allow better targeting of current and future suicide prevention programs.

Cognitive and Psychomotor Assessment Methods and Metrics

- The Automated Neuropsychological Assessment Metric is a DoD tri-service methodology for assessing cognitive performance/cognitive status. Includes a software application that can create up to 24 standardized cognitive tests (each with equivalent forms), display them, and capture and summarize the timeliness and accuracy of the person's performance being tested. Specific cognitive processes can be targeted (e.g., memory, attention, and switching from one task to another).
- Provides expedient measures of the impact of various moderators (e.g., dehydration, heat, workload, inadequate sleep, nutritional interventions, and training) upon the cognitive performance/cognitive status.

Guidance on Using Caffeine

- Guidelines for the use of caffeine to enhance warfighter cognitive performance and alertness during continuous and sustained operations. Because caffeine is available over the counter, widely accepted, and safe and effective, it remains the drug of choice for improving performance and alertness during sleep loss. Doses ranging from 100 to 300 mg (the equivalent of 1-3 cups of coffee or 2-4 caffeinated sodas) or 1-3 sticks of caffeinated gum every 3-4 hours restore performance and alertness to well-rested levels, and lower doses (50 to 100 mg every 3-4 hours) may be sufficient in persons who normally do not consume caffeine.
- Provides extended cognitive performance when operational conditions restrict and interrupt sleep.



Aidman Vision Screener (AVS)

- A set of charts for evaluating the effects of a potential laser exposure to the eye, which includes a visual acuity chart, Amsler Grid (central visual field evaluation), and criteria for evacuating patients. The AVS is included as part of a field evaluation kit.
- Provides field assessment capability for determining the severity of a laser eye exposure and whether to evacuate the patient.

Communications Earplug (CEP)

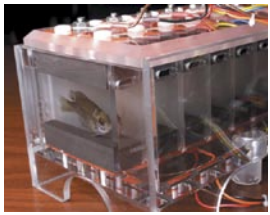
- An earplug that provides hearing protection while passing speech signals. Transducer is completely inside the external ear when properly inserted into the ear canal. Noise reduction rating of 29.5 dB. Compatible with various helmets and personal equipment.
- Provides for the protection of Soldier's hearing in high-noise operational environments and increases operational effectiveness by enhancing communication.

Design Guidelines for Advanced Imaging and Display Technologies

- Design criteria and test methods for imaging and display systems based on visual performance capabilities. Includes predictive models of visual performance with sensor and display systems in operational environments.
- Provides the means for evaluating new system designs and gives developers the information necessary to develop effective imaging/display systems for rotary-wing aircraft and other military vehicles.

Laser Exposure Standards to Prevent Laser Eye Injury

- Maximum permissible exposure limits to prevent eye injury from laser exposure during the design, testing, and deployment of advanced military laser systems, based on ocular injury thresholds, mechanisms, and physiological effects of laser exposure conditions inherent to new and threat military systems. Incorporated into the Army Radiation Safety Program described in Army Regulation 11-9 for laser radiation.
- Impacts the design of new military laser systems and protective equipment and provides the Army Medical Department with the tools necessary to assess field laser hazards when laser systems are used in testing, training, and operational scenarios.



Portable Aquatic Biomonitor

- A device that can rapidly detect a wide range of toxic chemicals or chemical mixtures in water sources by measuring changes in fish behavior. Fish are natural integrators of water quality conditions and respond to a wide range of chemicals/mixtures. Can be used at water treatment plants or other water production facilities.
- Protects drinking water supplies by continuously monitoring water. Tests have shown that the biomonitor responds within an hour to most chemicals at acutely toxic levels.

Rapid Analysis of Water for Select Chemical Contamination

- A solid-phase microextraction and gas-chromatography-mass spectrometry sampling and analysis method developed for two insecticides: carbaryl and lindane. Minimum levels of detection in environmental water sources are 10 µg/liter and 1.0 µg/liter for carbaryl and lindane, respectively.
- Total analysis time using field-portable equipment is 30 minutes. Avoids the use of complex sample preparation steps and enhances analyst safety by the elimination of handling solvents in field environments.

Total Army Injury Health and Occupational Database (TAIHOD)

- A database for answering epidemiological questions of injury and health outcomes relevant to the Army. Contains information on individual Soldier demographic and occupational characteristics, health outcomes, and health behaviors collected over the course of an Army Soldier's active duty career (for all Soldiers who have served on active duty since 1971, approximately 5 million individuals).
- TAIHOD provides the data necessary for the development of military health and safety policies.

Military Infectious Diseases

Combat Casualty Care

Military Operational Medicine

Medical Chemical and Biological Defense

Telemedicine, Logistics, IM/IT, and Facilities

Overview

Future battlefields are expected to be at least as dangerous as any of the past, or any that were anticipated during the Cold War.

Although treaties and agreements forbidding the use of chemical and biological weapons were milestones in arms control, they make no provision for monitoring and compliance; thus such weapons remain significant threats to U.S. and allied forces. The terrorist assaults of September 11, the anthrax letter attacks that followed, the stockpiles of chemical weapons found in Iraq after the 1990-91 Gulf War, the use of these weapons in the Iran-Iraq War, and the 1995 nerve gas attack in the Tokyo subway are vivid reminders of the potential risk and threat to both service members and civilians from these weapons.

Medical Chemical Defense Research

The mission of the Medical Chemical Defense Research Program (MCDRP) is to preserve combat effectiveness by timely provision of medical countermeasures in response to joint Service chemical warfare (CW) defense requirements. This program executes Department of Defense (DoD) medical chemical defense science and technology (S&T) research programs assigned to U.S. Army Medical Research and Materiel Command (USAMRMC) laboratories by the Defense Threat Reduction Agency's (DTRA's) Joint Science and Technology Office for Chemical and Biological Defense.

Nerve agents can be fatal to the unprotected warfighter. Survivors may have recurring seizures and long-term brain damage. Through joint research and development, the nerve agent threat has been substantially reduced by the fielding of numerous products:

- Soman Nerve Agent Pretreatment Pyridostigmine (SNAPP), a pretreatment drug, can be administered orally to troops under risk of CW attack without degrading their performance.

- Mark I Nerve Agent Antidote Kit (NAAK) provides the Soldier with the nerve agent antidote atropine and an oxime, 2-pralidoxime chloride (2-PAM).
- Antidote Treatment Nerve Agent Autoinjector (ATNAA) is an improvement over the Mark I NAAK.
- Convulsant Antidote for Nerve Agent (CANA)–diazepam in an autoinjector–is used as an adjunct therapy for nerve agent poisoning to protect against seizure-induced brain injury and to enhance survival.
- Medical Aerosolized Nerve Agent Antidote (MANAA) is an aerosolized atropine that can be rapidly administered far forward to casualties for the control of respiratory effects of nerve agents.
- Skin Exposure Reduction Paste against Chemical Warfare Agents (SERPACWA) is a topical pretreatment that forms a film barrier on the skin and augments Mission-Oriented Protective Posture (MOPP) gear by preventing or delaying the penetration of a wide variety of CW agents including the blistering agent sulfur mustard.

Research and product development supporting pretreatment, treatment, diagnostics, and clinical management of the chemical casualty are the keys to continuing discovery and fielding of medical countermeasures to CW agents. Successful ongoing programs in or nearing acquisition status include an Advanced Anticonvulsant System (AAS) and an Improved Nerve Agent Treatment System (INATS) with an improved oxime for treatment of nerve agent exposure. Active programs in the USAMRMC technology base include research to investigate the effects of low-level exposure to CW agents, research to develop medical countermeasures against vesicants and nontraditional agents, research on nerve agent neuroprotection, and a nerve agent pretreatment (bioscavenger).

The MCDRP also provides education and training to officers and enlisted persons from all Services who will be the doctors, nurses, and medics that will treat the warfighter exposed to CW agents. In addition, this information is periodically broadcast via satellite to first responders around the world who would likely be tending to casualties exposed to CW agents in the event of a terrorist action.

Medical Biological Defense Research

The mission of the Medical Biological Defense Research Program is to ensure the sustained effectiveness of U.S. forces in a biological warfare (BW) environment and to deter the use of these weapons by maintaining a strong medical defensive posture. This USAMRMC program executes DoD medical biological defense S&T research programs assigned to USAMRMC laboratories by the DTRA's Joint Science and Technology Office for Chemical and Biological Defense.

Vaccines and drugs for biological threat agents and toxins are designed to prevent casualties in the event of a BW attack. Diagnostic tests and reagents are developed to diagnose disease in the event of actual exposure to biological agents. Antitoxins and drugs are designed to treat casualties, prevent deaths, and expedite return to duty after exposure.

Technologies in advanced development include vaccines against Venezuelan equine encephalitis (VEE), plague, and a bivalent (A and B) recombinant botulinum vaccine. Several technologies are maturing to the point where they are being considered for transition to advanced development. These include medical diagnostic systems (reagents, protocols, and devices) for BW threats and endemic infectious diseases; a combined VEE, eastern and western equine encephalitis (VEE/EEE/WEE) vaccine; recombinant protective antigen (rPA) as a next-generation anthrax vaccine for inhaled anthrax; and vaccines against staphylococcal enterotoxin and ricin toxin exposure.

Research is ongoing to develop multiagent vaccines that would provide the capability for immunizing the warfighter against multiple biological threats with a single vaccine, development of vaccines against Marburg and Ebola viruses, pursuing needle-free delivery methods for recombinant protein vaccines, and development of a comprehensive, integrated diagnostic system that combines nucleic-acid-based and immunodiagnostic-based platforms. Ongoing research efforts are

also directed toward identifying and fully characterizing therapeutics against viral, bacterial, and toxin threats.

The most likely route of dissemination of a BW agent on the battlefield is through small-particle aerosols; therefore, researchers continue to develop, refine, and validate equipment and experimental models used to study airborne infection and disease prevention. If exposure and illness occur, rapid diagnosis is essential for proper treatment and medical management. Field-deployable, rapid assays are being developed for diagnosis of BW agent exposure.

In addition to research and development (R&D), training military and civilian health care professionals in the diagnosis and treatment of BW agent exposure is a Command priority. USAMRMC experts also provide technical support to law enforcement agencies and counterterrorism initiatives.

The products in this section are divided into medical chemical defense products and medical biological defense products, and then subcategorized appropriately.

Advanced Anticonvulsant System (AAS)

Mission

Nerve agent exposure can cause seizures/convulsions in warfighters. The use of an anticonvulsant provides an effective treatment for service members against nerve agent-induced seizures and subsequent brain damage caused by nerve agent exposure.

Description

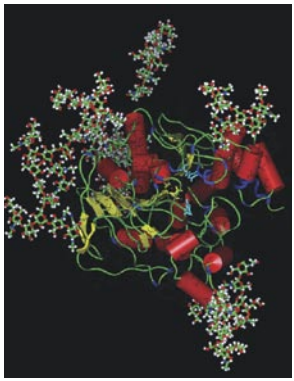
The AAS will provide an intramuscular administration of the drug, midazolam, to protect against seizures and subsequent neurologic damage. Midazolam is more water-soluble than diazepam (the currently fielded medication) and terminates nerve agent-induced seizures more quickly. The AAS will not eliminate the need for other protective and therapeutic systems. It will serve as a replacement for the currently fielded CANA, which uses diazepam.

Laboratory/Developer

Medical Identification & Treatment Systems (MITS) Joint Product Management Office (JPMO)

U.S. Army Medical Research Institute of Chemical Defense (USAMRICD)

Chemical Agent Prophylaxis



Mission

An effective prophylaxis for CW nerve agents will increase the ability of U.S. forces and allies to sustain operational tempo, provide full-dimension protection, reduce reliance on MOPP gear, and discourage the use of nerve agents by the enemy.

Description

The current therapeutic approach to nerve agent exposure is successful. However, prevention of the toxins' effects is preferred.

This research effort is intended to yield a prophylactic that can detoxify nerve agents at a rate sufficient to protect U.S. forces from nerve agent intoxication. To date, the effort has developed a first-generation bioscavenger made from expired human blood – human butyrylcholinesterase (HBuChE). It combines with the nerve agents to provide extended protection against a wide spectrum of nerve agents without causing side effects, behavioral effects, or the need for extensive postexposure therapy.

Laboratory/Developer

USAMRICD
Walter Reed Army Institute of Research (WRAIR)

Product Status: **PROMISING** ◆ FUTURE ◆ COMPLETED

Medical Chemical Defense Subcategory: ***Therapeutics***

Improved Oximes

Mission

The use of improved oximes will provide more effective emergency treatment of nerve agent exposure on the battlefield.

Description

Nerve agents attack and inhibit the cholinesterase enzymes in the body. The inhibited enzymes are then reactivated by the oximes, breaking the agent-enzyme bond and restoring normal enzyme activity to the body. Currently, military personnel are issued an autoinjector containing pralidoxime chloride (2-PAM) for emergency treatment of nerve agent intoxication that provides adequate protection against the conventional nerve agents sarin (GB) and VX (O-ethyl-S-[2(diisopropylamino)ethyl] methylphosphonothioate) but is less effective against other conventional agents (i.e., tabun [GA], soman [GD], and cyclosarin [GF]) and emerging threats, such as Russian V-agent (VR).

The result of this research program will be an improved, broad-spectrum oxime(s) that is significantly more effective than 2-PAM against conventional agents and emerging threats.

Laboratory/Developer

MITS JPMO
USAMRICD

Cyanide Medical Countermeasures

Mission

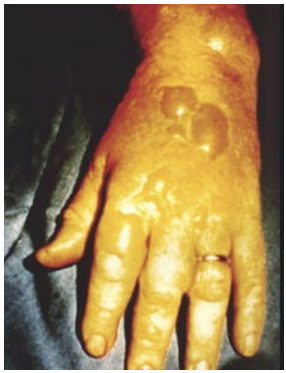
Medical countermeasures against cyanide intoxication and the development of more accurate and reliable methodologies to assay for cyanide from biological samples will provide additional protection to Soldiers on the battlefield.

Description

Cyanide is a fast-acting inhibitor of cellular respiration. No pretreatment against cyanide is presently available, and modern cyanide treatments accessible to DoD personnel have serious limitations. Pharmaceutical countermeasures against cyanide (i.e., pretreatments and treatments) must act rapidly, have relatively long half- and shelf-lives, and present no or minimal side effects. Efforts are ongoing to identify pretreatment compounds that will protect the target of cyanide. In addition, scavengers for cyanide are being tested as treatments and pretreatments.

Laboratory/Developer

USAMRICD



Medical Countermeasures for Vesicant Agents

Mission

Medical countermeasures will demonstrate a safe and effective pharmacological pretreatment to prevent or decrease the severity of injuries caused by sulfur mustard (HD).

Description

Vesicant chemical agents such as HD are a significant threat to U.S. forces, and there is currently no vesicant (mustard) agent treatment available. This work will yield a vesicant agent countermeasure that will substantially reduce the number of casualties or degree of injury, reduce the medical logistical burden, deter use of HD, and enhance the ability of U.S. forces to sustain operational tempo.

Laboratory/Developer

USAMRICD

Skin/Wound Decontamination

Mission

A method for skin/wound decontamination will enhance survival and sustainability of U.S. forces in need of emergency decontamination products following nerve agent exposure.

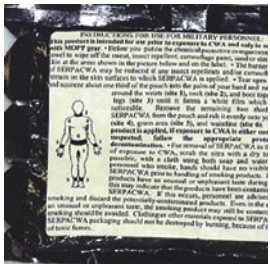
Description

Current techniques of decontamination include activated charcoal that is rubbed over the body to absorb the chemical agent. One technology being explored is a cotton sponge impregnated with enzymes, including acetylcholinesterase (AChE), that seize surrogate organophosphorus compounds (OPs) or nerve agents and inactivate them before they can do harm. The additives in the sponge remove, contain, and destroy the OPs, preventing further contamination.

The sponge reacts to a nerve agent by changing color. Because it is made of cotton fabric, it is inexpensive and sturdy and should not require any special training for its use. It has already been shown to be stable when stored at 45°C. Decontamination of OP surrogates is currently being tested in animals.

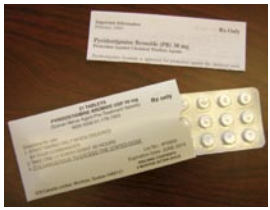
Laboratory/Developer

USAMRICD
WRAIR



Skin Exposure Reduction Paste against Chemical Warfare Agents (SERPACWA)

- Will enhance the survival and sustainability of U.S. forces in need of prophylaxis to nerve agent and HD exposure.
- An FDA-approved paste containing chemically inert perfluorinated polymers that delay or prevent penetration of nerve agents and HD. Used as a pretreatment in conjunction with MOPP gear to prevent or reduce the toxicity resulting from CW agents on the skin.
- Completed date: 2000.

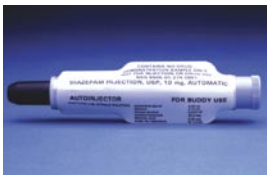


Soman Nerve Agent Pretreatment Pyridostigmine (SNAPP)

- Will protect U.S. forces by supplying pretreatment for nerve agent (soman) exposure.
- Previously used as a treatment for a chronic neuromuscular disease known as myasthenia gravis, SNAPP is now FDA approved as a prophylaxis against the lethal effects of the nerve agent soman. It is the first such drug to be approved under the FDA's "animal rule."
- Used in conjunction with current antidotes.
- Completed date: 2003.

Antidote Treatment Nerve Agent Autoinjector (ATNAA)

- Provides treatment for nerve agent exposure of U.S. forces.
- Contains atropine and 2-PAM in a single autoinjector. Replacement for Mark I; smaller and less expensive.
- Completed date: 2002.



Convulsant Antidote for Nerve Agents (CANA)

- Offers U.S. forces additional protection from nerve agent poisoning.
- A diazepam 10-mg autoinjector used for the prevention or abatement of convulsions and the prevention or reduction of brain injury associated with nerve agent poisoning. An FDA-approved, Soldier-carried item used with the Mark I NAAK.
- Completed date: 1991.

M291 Skin Decontaminating Kit

- Emergency decontamination products that can remove and neutralize potentially lethal CW and BW agents following agent exposure.
- A superior, safe, and effective skin decontamination system for use against multiple percutaneous CW agents. Wallet-like, flexible pouch contains six individually sealed foil packets and is carried in the pocket of protective suits.
- Completed date: 1990.

Mark I Nerve Agent Antidote Kit (NAAK)

- Provides treatment for nerve agent exposure of U.S. forces.
- Administered when personnel are exposed to nerve agents such as sarin, soman, tabun, and VX and have signs and symptoms of exposure. Contains two multichamber autoinjectors containing 2 mg of atropine and 600 mg of 2-PAM each.
- Completed date: 1983.

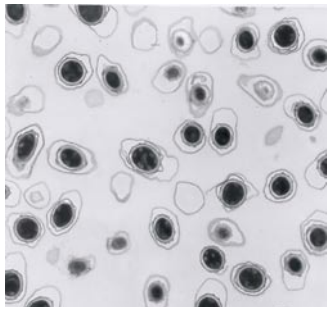
Medical Aerosolized Nerve Agent Antidote (MANAA)

- Will increase the survival and sustainability of U.S. forces by supplying treatment for nerve agent exposure.
- Packaged as a pressurized inhaler device containing aerosolized atropine to counteract the effects of nerve agents such as tabun, sarin, soman, GF, and VX.
- Completed date: 1994.

Test-Mate Cholinesterase Kit

- Provides U.S. forces with superior protection against nerve agent exposure with the ability to detect the presence of AChE.
- Measures blood enzymes erythrocyte AChE and/or plasma cholinesterase providing detection of nerve agent exposure in less than 4 minutes. Contains a battery-operated colorimeter, a photometric analyzer, and all equipment and reagents necessary for performing up to 96 tests. Blood for each test is easily obtained from a finger stick.
- Completed date: 1997.

Next-Generation Anthrax Vaccine



Mission

An anthrax vaccine will protect U.S. forces, decrease the threat of a biological attack, and enhance strategic mobility.

Description

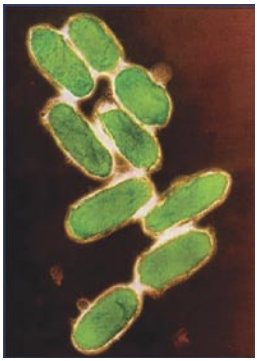
Anthrax is caused by spores and most commonly occurs in wild and domestic mammals, although it has been manufactured as a BW agent. Symptoms vary depending on the route of exposure; however, sore throat, mild fever, and muscle aches usually begin within 7 days of exposure. Severe breathing difficulty, shock, and meningitis follow, and as the bacteria multiply in the lymph nodes, toxemia progresses and the potential for widespread tissue destruction and organ failure increases. Up to 90% of untreated cases result in death. Currently, ciprofloxacin is the only antibiotic approved by the FDA to treat anthrax exposure.

Obtaining an alternative for the currently licensed anthrax vaccine would provide the DoD with additional options in protecting the force against this serious BW threat. The objective of this research is to characterize an rPA anthrax vaccine candidate in an attempt to provide protective immunity against aerosol exposure to anthrax spores.

Laboratory/Developer

National Institute of Allergy and Infectious Diseases (NIAID)
USAMRIID

Plague Vaccine (Recombinant Plague Vaccine)



Mission

An effective FDA-licensed vaccine against aerosolized plague will enhance force protection and strategic mobility.

Description

Infection induced by inhalation of *Yersinia pestis* represents a serious BW threat. The resultant disease, pneumonic plague, has an incubation period of 2 to 5 days and an untreated mortality rate of nearly 100% within 1 to 3 days after the onset of illness. The disease can be transmitted through flea bites and is characterized by high fever, chills, headache, malaise, myalgias, cough with blood-tinged sputum, and tender, swollen lymph nodes.

The disease progresses rapidly, resulting in epigastric discomfort, noisy respiration, and a bluish discoloration of the skin followed rapidly by respiratory failure, circulatory collapse, and bleeding tendancies if left untreated. The previously licensed plague vaccine did not protect against aerosolized *Y. pestis* and is no longer being manufactured.

Preclinical studies for the safety and efficacy of the recombinant F1-V fusion protein vaccine candidate have been completed in animals. The F1-V fusion protein moved into technology development in January 2004. Additional preclinical studies are required to define optimal dosing schedules, long-term immunogenicity, and duration of protection.

Laboratory/ Developer

Program Manager
(PM) Joint Vaccine

Recombinant Multivalent Botulinum (A and B) Vaccine

Mission

An effective FDA-licensed vaccine against aerosolized botulinum toxins A and B will enhance force protection and strategic mobility.

Description

The paralytic neurotoxins elaborated by *Clostridium botulinum* are the most potent, naturally occurring toxins known. Botulism is acquired naturally by oral ingestion of the organism or infection of a preexisting wound. Direct intoxication of humans can be accomplished by aerosolizing the toxin, leading to intoxication by inhalation. Botulism symptoms appear within hours to days following exposure to botulinum toxin. All symptoms are the result of irreversible binding of the toxin to neurons. Typical symptoms include nausea, vomiting, headache, dry mouth, urinary retention, intestinal obstruction, and general neurologic disorder characterized by weakness and dizziness. Eventually the illness results in weakness in descending extremities and respiratory muscles. Respiratory paralysis is most often the immediate cause of death.

Recombinant multivalent botulinum vaccine would provide protection against botulinum neurotoxins A and B and would replace the current vaccine, now available under Investigational New Drug (IND) status. This candidate vaccine would be easier to manufacture, require fewer doses, and provide better immunogenicity.

Laboratory/Developer

NIAID
PM JVAP
USAMRIID

Recombinant Ricin Vaccine Candidate

Mission

A ricin vaccine will decrease the threat of a biological attack and enhance strategic mobility of U.S. forces.

Description

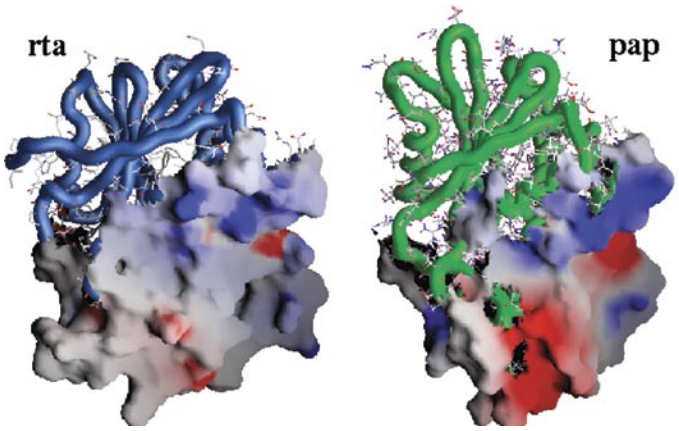
Ricin is a toxin derived from the castor plant, which is grown throughout the world for commercial purposes. Approximately one million pounds of castor beans are used each year in the process of manufacturing castor oil. Given its ready availability and its high level of toxicity – particularly when delivered as an aerosol – ricin is a significant potential agent of BW or terrorism. Currently, there is no vaccine or therapy available for human use.

The new vaccine candidate, called RTA 1-33/44-198, is a fragment of the ricin toxin A-chain that has been modified to eliminate the toxic enzymatic property of RTA, increase protein stability, and maintain its ability to elicit a protective immune response. The vaccine fully protected mice from a whole-body aerosol challenge with lethal doses of ricin.

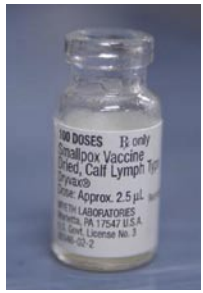
Next steps include testing in nonhuman primates and refinement of a scaled-up production method that is robust and reproducible.

Laboratory/Developer

USAMRIID



Smallpox Vaccine



Mission

A smallpox vaccine will decrease the threat of a biological attack and enhance strategic mobility of U.S. forces.

Description

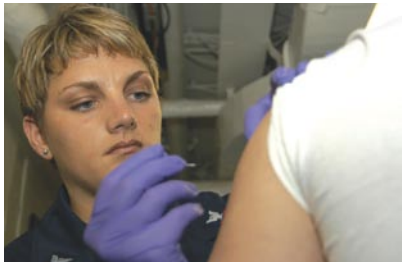
Smallpox is a viral disease that was declared eradicated by the World Health Organization (WHO). Consequently, the general public is no longer routinely vaccinated. This leaves a highly vulnerable population, especially when smallpox is considered to be a prime candidate for use as a biological weapon. The case fatality rate of smallpox disease among unvaccinated individuals is between 15% and 40%. The disease can be transmitted through casual contact.

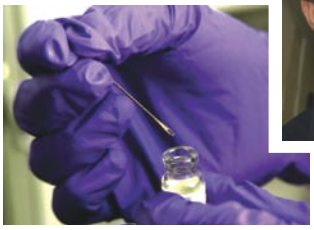
An improved vaccine to protect against this BW threat is highly desirable. Only limited doses of the current smallpox vaccine are available, and there are significant reservations about mass inoculation due to its known side effects. There is also a limited supply of vaccinia immune globulin (VIG), which is used to treat smallpox vaccine adverse reactions.

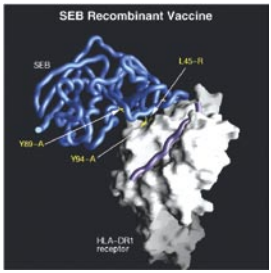
This development effort is designed to produce a more consistent and more manufacturable vaccine using better defined and controllable cell culture production techniques and to replenish the nation's supply of VIG from the ready pool of vaccinia-immunized individuals within USAMRIID and the laboratory community.

Laboratory/Developer

Smallpox Vaccine: NIAID
VIG: PM JVAP
USAMRIID







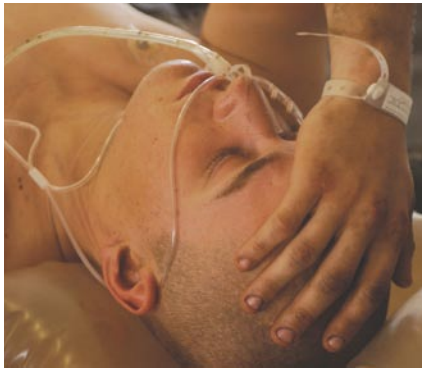
Staphylococcal Enterotoxin A/B (SEA/B) Multivalent Vaccine Candidate

Mission

Recombinant staphylococcal enterotoxin serotypes A and B (SEA/B) multivalent vaccines will decrease the threat of a biological attack and enhance strategic mobility of U.S. forces.

Description

Staphylococcus aureus produces a number of toxic proteins, including SEA/B. These are part of a larger group of superantigen toxins capable of directly stimulating a large population of immune cells and inducing an intense inflammatory response that injures host tissues. Symptoms begin approximately 3 to 12 hours after aerosol infection and include flu-like and respiratory signs, which may persist for weeks. Severe exposures can result in acute pulmonary edema and respiratory failure. These toxins are easily manufactured and very stable. There are currently no FDA-licensed vaccines or therapeutics for protection from SEA/B.



The recombinant SEA and SEB vaccine components are expressed in *Escherichia coli.* Preclinical safety, efficacy, and long-term immunity have been demonstrated in rodents and NHPs. Furthermore, scalable manufacturing and purification processes, formulation studies, and lot release criteria have been developed. These accomplishments serve as a basis for considering the SEA/SEB vaccine candidates of sufficient maturity to transition out of the tech base.

Laboratory/Developer

USAMRIID

Product Status: **PROMISING** ◆ FUTURE ◆ COMPLETED

Medical Biological Defense Subcategory: ***Prevention***

Tularemia Vaccine

Mission

A tularemia vaccine will decrease the threat of a biological attack and enhance strategic mobility of U.S. forces.

Description

Tularemia is an incapacitating and occasionally fatal infection transmitted to humans by fly and tick bites. Clinical symptoms are often confused with those of plague; therefore, tularemia can be very difficult to diagnose. Infection induced by inhalation or ingestion of *Francisella tularensis* organisms represents a serious BW threat because only a small amount is necessary to cause infection. Antibiotics may not be a viable option in the theater of operations, and there is no U.S.-licensed tularemia vaccine.

The tularemia vaccine under development has been demonstrated to provide 80% protection for 1 year after one dose and elicits an immune response within 45 days of vaccination. It has a 2-year shelf life but is not yet approved by the FDA.

Laboratory/ Developer

NIAID
USAMRIID

Venezuelan Equine Encephalitis Infectious Clone Vaccine

Mission

A vaccine to protect against VEE threat agents will decrease the susceptibility of U.S. forces and may deter potential BW attacks.

Description

The VEE virus is a highly infectious agent that is easily manufactured in large quantities, stable in storage, and efficiently transmitted by aerosol. The alpha viruses are amenable to genetic manipulations, thereby increasing their potential as BW weapons. Intentional release of small-particle aerosol (10 grams of purified virus) from a single airplane is expected to infect a high percentage of people within an area of at least 30,000 square kilometers. Clinical manifestations include a sudden onset of a nonspecific febrile illness that consists of malaise, fever, chills, headache, retro-orbital pain, nausea, vomiting, and sore throat. The acute phase of the illness lasts 4-6 days, with total recovery taking 2-3 weeks. There is no antiviral with recognized efficacy against VEE infection and medical intervention remains limited to supportive care.

The VEE Infectious Clone Vaccine, designated V3526, is a genetically engineered, live-attenuated virus that will be administered subcutaneously. Because this is a live viral product, only one vaccination will be required. The vaccine will elicit an immune response within 30 days, provide 80% protection for 1 year, and have a shelf life of at least 3 years.

Laboratory/Developer

PM JVAP
USAMRIID

Product Status: **PROMISING** ◆ FUTURE ◆ COMPLETED

Medical Biological Defense Subcategory: ***Diagnostics***

Joint Biological Agent Identification and Diagnostic System (JBAIDS)

Mission

JBAIDS will decrease the severity of a biological attack and enhance strategic mobility of U.S. forces by giving commanders the ability to rapidly identify exposure to BW and infectious disease agents.

Description

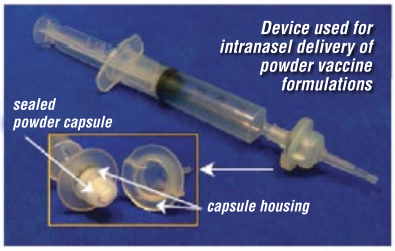
Mass casualties and fatalities caused by biological agents are very real threats. A device to reliably and rapidly detect these agents and pathogens has become a necessity.

Compact and portable, the JBAIDS can simultaneously and reliably identifying multiple BW agents and other important pathogens that affect military operations and homeland security. The instrument is capable of analyzing clinical as well as environmental samples. JBAIDS is in advanced development and represents the first DoD developmental effort for a common identification and diagnostics platform.

USAMRIID develops state-of-the-art technologies and critical reagents, protocols, and devices to support rapid and confirmatory identification of biological threat agents. Diagnostic assays developed at USAMRIID are standardized, optimized, and transitioned for use with the JBAIDS.

Laboratory/Developer

MITS JPMO
USAMRIID



Transdermal and Intranasal Vaccination Technology for Protection against Biological Threats

Mission

A new method of mass vaccination to prevent infections with biological threat agents will decrease the threat of a biological attack and enhance strategic mobility of U.S. forces.

Description

A collaborative study between USAMRIID and Becton Dickinson Technologies demonstrated that administration of rPA of *Bacillus anthracis* to the skin or nasal mucosa using novel, inexpensive, and disposable medical devices provides a high level of protection against aerosol challenge of rabbits with anthrax-causing spores. These studies were also facilitated by development of a new rPA powder formulation intended to reduce the requirement for cold storage of the vaccine and to target nasal vaccination.

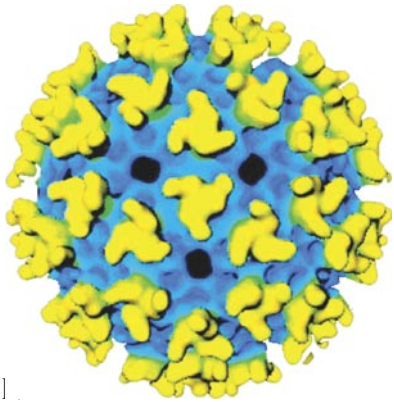
Pulmonary anthrax is an acute infectious disease caused by inhalation of spores from the bacterium *B. anthracis.* Antibiotic treatment is effective during the early stage of disease but is difficult once the bacteria have reached a more advanced stage, and death often ensues. The current licensed vaccine in the U.S. is Anthrax Vaccine Adsorbed (AVA). A new anthrax vaccine based on rPA of *B. anthracis* is being developed. PA is nontoxic and is the protective component of AVA.

During the next stage of development, human clinical trials will be performed to determine the overall safety of this new vaccine/device combination for anthrax. Transdermal and intranasal delivery devices are also being studied for use with vaccines against other BW agents.

Laboratory/Developer

USAMRIID

Vaccine Constructs for a Combined Equine Encephalitis Vaccine



Mission

A multivalent vaccine that protects against Venezuelan, eastern, and western equine encephalitis (VEE/EEE/WEE) would decrease the threat of a biological attack and enhance strategic mobility of U.S. forces.

Description

In addition to developing a new candidate vaccine for VEE, USAMRIID research is focused on developing safe and efficacious vaccines for EEE and WEE. Like VEE, these viruses are highly infectious and easily transmitted by the aerosol route. Current vaccines for EEE and WEE are available for IND use only and have been found to be relatively ineffective in a significant portion of the recipients. Three approaches are being pursued: naked DNA vaccines, replicon-vectored vaccines, and live-attenuated vaccines derived by genetic engineering.

USAMRIID scientists are also working to confirm cross protection among various strains of VEE, EEE, and WEE with the ultimate goal of developing a multivalent vaccine that would protect against all three viruses.

Laboratory/Developer

USAMRIID

Vaccine Technologies for Protection against Filovirus Exposure

Mission

Vaccines against the filoviruses Ebola and Marburg would protect military populations at risk of exposure and also decrease the associated hazard to medical and laboratory personnel.

Description

The filoviruses Ebola and Marburg cause hemorrhagic fevers with human case fatality rates up to 80%. They are a global health concern and are potential BW agents. Currently, there are no available vaccines or therapies.

USAMRIID scientists have made and patented several potential vaccines against Ebola and Marburg viruses using different vaccine strategies, including gene-based (DNA), replication-defective viral vectors (alphavirus replicons), and virus-like particles (VLPs) using two filovirus proteins. These have all been tested successfully in rodents, and some have demonstrated efficacy in nonhuman primates (NHPs). In addition, USAMRIID investigators are collaborating with scientists in other government agencies, industry, and academia to test experimental adenovirus-vectored and rhabdovirus-vectored vaccines for Ebola and Marburg viruses. At least one of these candidate vaccines successfully protected NHPs from Ebola virus.

The USAMRIID team is also investigating the pathogenesis of disease and the acquired immune responses that are necessary to fight Ebola and Marburg virus infections, this knowledge being vital to developing and licensing vaccines and treatments. Institute scientists have identified protective roles for both cytotoxic T cells and antibodies.

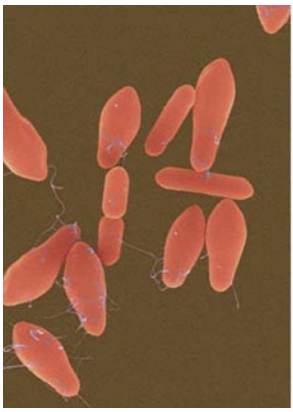
Laboratory/Developer

USAMRIID

Therapeutic Strategies for Botulinum Neurotoxins

Mission

An FDA-licensed treatment for botulinum intoxication will reduce warfighter morbidity and mortality by reducing the toxin burden in the system prior to the onset of severe symptoms.



Description

Botulinum neurotoxins are the most toxic biological substances known. These toxins bind to peripheral cholinergic nerve cells, rendering them inactive and causing neuromuscular paralysis, respiratory failure, and death. Current treatment for botulinum intoxication involves weeks of intensive care.

USAMRIID has worked closely with the University of California at San Francisco to develop monoclonal antibodies to treat all seven serotypes of botulinum neurotoxin. These efforts resulted in a combination of three human-compatible monoclonal antibodies that bind to the toxin, rendering it harmless.

The NIAID, one of the National Institutes of Health, has awarded a contract to XOMA/SRI to produce three human monoclonal antibodies against botulinum neurotoxin A.

Laboratory/Developer

NIAID
University of California at San Francisco
USAMRIID
XOMA/SRI

Therapeutic Strategies for Treating Filovirus Infection

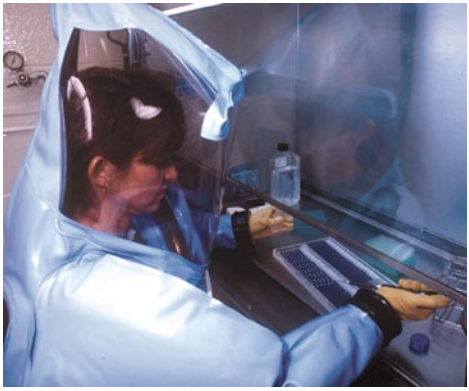
Mission

Drugs to treat infection with the filoviruses Ebola and Marburg would reduce warfighter morbidity and mortality and also decrease the associated hazard to medical and laboratory personnel.

Description

USAMRIID scientists are identifying viral targets as well as strategies for treatment of clinical symptoms and are evaluating an extensive array of drugs and antibodies for their potential in therapeutic and/or prophylactic treatments of filovirus infections. The USAMRIID team has identified new targets as well as lead compounds and small molecules for further exploration. One drug, recombinant nematode anticoagulant protein c2 (rNAPC2), successfully protected some monkeys from challenge with Ebola virus, apparently by blocking the abnormal blood clotting that is characteristic of Ebola infection.

Monoclonal antibodies to Ebola virus isolated from vaccinated mice by the USAMRIID team protected mice from challenge when administered as late as 2 days after infection, and other monoclonal antibodies have protected guinea pigs from lethal Marburg virus infection. The former are currently being humanized in collaboration with Arizona State University, Biovation, and The Dow Chemical Co. for further evaluation as a potential treatment.



Laboratory/ Developer

Arizona Sate University
Biovation
The Dow Chemical Co.
USAMRIID

Therapeutics for Smallpox and Other Orthopoxviruses

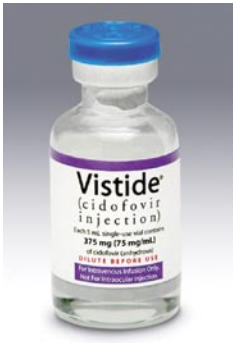
Mission

An FDA-licensed treatment for smallpox and other pathogenic orthopoxviruses will reduce warfighter morbidity and mortality and control the spread of disease.

Description

Smallpox was eradicated in 1979 through the efforts of the WHO. Currently, the virus is known to exist only in two WHO-sanctioned repositories. However, there is concern that undisclosed reference stocks may exist, and the U.S. population is no longer routinely immunized against smallpox. Due to the potential for the virus to be used as an agent of BW or bioterrorism, antiviral drugs are urgently needed.

Because smallpox no longer occurs naturally, vaccine and drug candidates cannot be tested for their ability to prevent or treat the disease in humans. Licensing of future medical countermeasures for smallpox will depend upon animal studies. The FDA has established an Animal Efficacy Rule to facilitate the approval of vaccines and drugs for biological agents in cases where efficacy data in humans cannot be obtained.



Cidofovir, sold under the trade name Vistide™, is approved by the FDA for the treatment of cytomegalovirus retinitis in AIDS patients. Intravenous cidofovir inhibits the viral DNA polymerase, thus stopping the replication of smallpox and other pathogenic orthopoxviruses and disease progression in primate models. Additional studies will lead to development of an oral formulation that can be more readily administered.

Laboratory/Developer

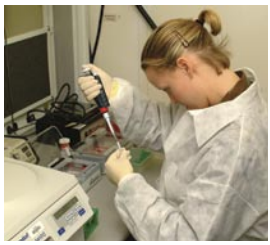
JPEO-CBD JVAP
NIAID
USAMRIID

Anthrax Vaccine Adsorbed (Biothrax™)

- Protects U.S. forces against all forms of anthrax, decreases threat of a biological attack, and enhances strategic mobility.
- A sterile, cell-free filtrate containing proteins made from an avirulent strain of *B. anthracis*. This FDA-licensed vaccine meets requirements for safety, efficacy, purity, and potency. It is marketed as a sterile injectable suspension in 10-dose vials and is delivered by subcutaneous injection of 0.5 mL.
- Produced for the DoD under contract with BioPort Corporation.

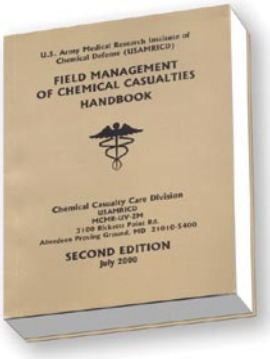
Computer Based Training (CBT)

- Offers a variety of interactive multimedia learning courses online and in CD format.



Field Identification of Biological Warfare Agents (FIBWA) Course

- Four-week course that allows students to set up, maintain, and operate a deployable laboratory under field conditions. Includes classroom instruction, extensive hands-on laboratory training in diagnostic techniques, and a field exercise that integrates course material with real-world scenarios.
- Concepts of operations and diagnostic materials, equipment, and technology are continually evaluated and transitioned into the field to ensure that training is cutting edge.
- Six student courses and three "manager" courses for laboratory officers and commanders are offered each year. While FIBWA is designed for organizations within the DoD, course material can be tailored to meet the specific needs of other government agencies.

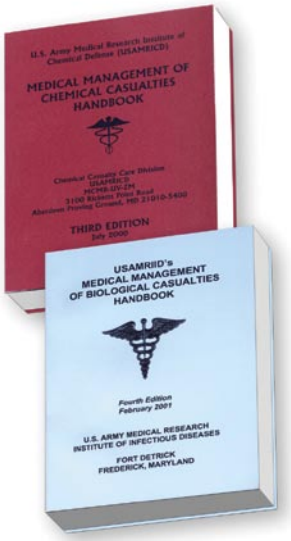


Field Management of Chemical and Biological Casualties (FCBC) Course

- The FCBC Course is designed for medical and chemical noncommissioned officers, Chemical and Medical Service Corps officers, and civilian first responders. Instruction focuses on emergency treatment, triage, decontamination, and evacuation of casualties.

Hospital Management of Chemical, Biological, Radiological/Nuclear and Explosive Incident Course (HM-CBRNE)

- This course is designed to equip military and civilian hospital-based medical and management professionals with skills, knowledge, and information resources to carry out the full spectrum of health care facility responsibilities required by a CBRNE or mass casualty event. Classroom and practical application instruction focuses on diagnosis, treatment, and incident management in response to mass casualty events of all types, including incidents involving weapons of mass destruction.



Medical Management of Chemical and Biological Casualties (MCBC) Course

- The course is conducted jointly by USAMRICD and USAMRIID. The MCBC Course is designed for physicians, nurses, and other medical professionals. Classroom, laboratory, and field instruction focuses on pathophysiology, diagnosis, and treatment of chemical and biological casualties.

For more information on training courses, please visit https://ccc.apgea.army.mil

Telemedicine, Logistics, IM/IT, and Facilities

Overview

Medical research, technology, and materiel for the 21st century warfighter.

This final chapter of the USAMRMC Product Portfolio combines products in several mission areas. Some of the "products" are actually services provided to Army and Department of Defense (DoD) customers on a continuing basis. Whether tangible product or available service, each output enhances the medical capabilities of the military services.

Telemedicine and Advanced Technology Research Center (TATRC)

The USAMRMC's Telemedicine and Advanced Technology Research Center manages congressionally mandated advanced technology projects in telemedicine and advanced medical technologies. Projects include identification, exploration, and demonstration of key technologies that will reduce the medical "footprint" and increase medical mobility, while ensuring warfighters have access to essential medical expertise and support wherever they deploy. By leveraging its partnerships with industry and academia, the TATRC helps make medical care and services more accessible to warfighters, reduces costs, and enhances the overall quality of health care in wartime and peacetime.

Medical Logistics

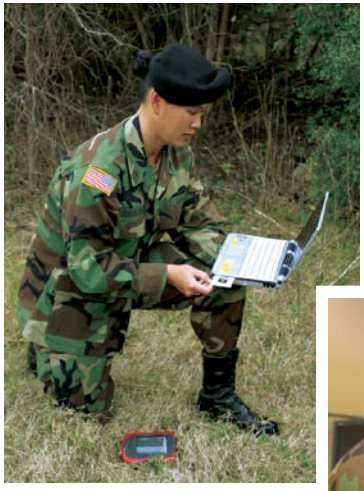
The USAMRMC's responsibilities in the medical materiel arena include medical materiel acquisition and logistics functions, strategic medical logistics readiness, and critical health care programs. The U.S. Army Medical Materiel Agency (USAMMA) and the U.S. Army Medical Materiel Center–Europe (USAMMCE), the Command's logistics organizations, provide direction and resources, acquire and manage assets, provide capabilities and distribute materiel, and support the national military strategy of power projection. Key programs include the acquisition, storage, distribution, and transfer of pre-positioned stocks located ashore and afloat, medical chemical defense packages, short shelf-life pharmaceuticals, and other materiel. Integral to this support are partnerships with defense organizations and inventory-management contracts with industry. The Command also supports deployable medical logistics support teams.

Both USAMMA and USAMMCE explore and employ innovative methods to bring best business practices and new information technologies to the medical logistics system. Such focused logistics initiatives provide more efficient and accurate ways to deliver and manage precision packages and biomedical maintenance capabilities.

Information Management/Information Technology (IM/IT)

The USAMRMC is the Army Medical Department's (AMEDD's) IM/IT materiel developer. Through the U.S. Army Medical Information Technology Center (USAMITC), the Command provides program management support for IM/IT initiatives that cut across organizational boundaries or have significant life-cycle costs.

The USAMITC is the Command's organization for deploying and sustaining IM/IT systems supporting the AMEDD as well as tri-service organizations around the world. These systems include a data transport network, bandwidth services, voice and video services, network management, VTC room deployment and certifications, MEDCOM worldwide e-mail, dial-in services, and computer systems security administration. Through these efforts, the Command provides complete life-cycle solutions supporting the AMEDD's IM/IT needs.



Health Care Facilities

The ultimate extension of the Command's medical materiel mission is its services to provide health care facilities. The U.S. Army Health Facility Planning Agency (USAHFPA) consists of deployable experts in planning, programming, design, construction, transition, and sustainment of medical and dental facilities. The USAHFPA provides assistance in assessing and refining facility requirements of the AMEDD and other customers and then executing design and construction investments whenever and wherever needed. The Agency also deploys special response teams during operations other than war, disaster relief, peacekeeping efforts, and nation building.

Advanced Surgical Technologies (AST)

Mission

AST will use progressive advanced technologies in communication and patient care to improve efficiency and safety of military and civilian operating rooms (ORs).

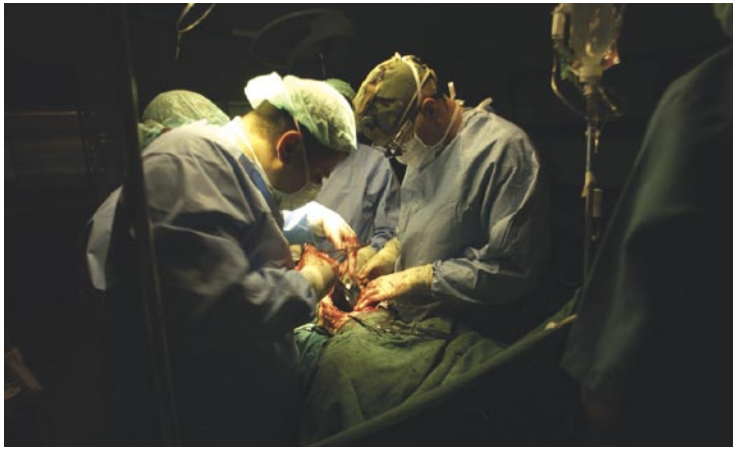
Description

The OR is a highly complex environment of startling isolation in real time. Staff teamwork is fragmented and requires an inordinate amount of voice communication resulting in negative unplanned events occurring frequently and in clusters. In addition, valuable time is wasted; quality indicators, including patient safety, are assessed only in retrospect; and too much energy is expended on making the OR function instead of direct patient care.

AST will integrate existing pockets of research through collaboration to implement advancing medical technologies in both the federal and civilian health care systems and stimulate new research and development focused specifically within the following topical research areas: patient safety, advanced devices, medical informatics, telesurgery, and perioperative systems design.

Laboratory/Developer

TATRC



Battlefield Medical Information System Telemedicine (BMIST)

Mission

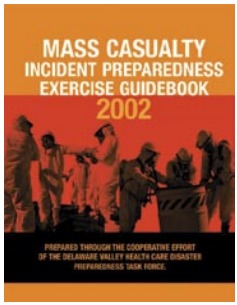
On the battlefield, it is crucial for first responders to have current medical information at the point of care. BMIST is a diagnostic tool that provides useful medical informatics and telemedicine support across the spectrum of the military health care operations and continuum of support levels of care.

Description

BMIST, a wireless handheld device, enables first responders (and other health care staff) to quickly and accurately capture, integrate, transmit, and display data from medical histories/physical examinations, medical reference libraries, diagnostic and treatment decision aids, medical sustainment training, and medical mission planning. The personal digital assistant (PDA) can be used by military health care providers at all levels of care from the foxhole to the medical center. BMIST supports a user interface that includes help windows and decision rationale. The system is easily adaptable to evolving medical procedures and protocols in addition to new medical databases and mission requirements. Under adequate conditions, BMIST is capable of supporting real-time "teleconsultation" between the first responder and expert medical staff in different locations. BMIST was named as one of the Army's 10 Greatest Inventions for 2003.

Laboratory/ Developer

TATRC



Emergency Department Self-Assessment Survey and Incident Scenario Exercise Guidebook for CBRNE Response Preparedness

Mission

This guidebook will promote the development of an effective response by the civilian medical community to chemical, biological, radiological/nuclear, and explosive (CBRNE) terrorist attacks through the use of online tools and advanced distributed learning.

Description

A hospital self-assessment survey for emergency department preparedness has been developed by the National Bioterrorism Civilian Medical Response Center (CIMERC) at Drexel University as a deliverable under government contract, funded by congressional appropriation. Based largely upon the Soldier and Biological/Chemical Command Domestic Preparedness Training Manual and input from an expert consensus panel, the survey was designed to determine emergency department readiness to generate a minimal level of reasonable response to a chemical or biological mass casualty event, regardless of population base or surge capacity. The self-assessment survey, containing 14 questions, can be accessed online at www.cimerc.org and can be completed within several minutes. References and expert opinions are also accessible. The survey can be used to provide a snapshot of regional readiness, as well as to support targeted allocation of health care resources. Also developed by CIMERC, and available on the website, is the online version of a guidebook entitled "Strategies for Incident Preparedness: A National Model." This disaster preparedness training handbook contains 20 different CBRNE disaster scenarios. Both the self-assessment survey and guidebook have been translated into Spanish and are currently being evaluated in Latin America.

Laboratory/Developer

CIMERC
TATRC

Forward-Deployed Digital Medical Treatment Facility (FDDMTF)

Mission

A Joint U.S. Air Force/U.S. Army lightweight, wireless, digitized forward surgical and hospitalization capability will support the Army Transformation Interim Brigade Combat Teams, Army or Air Force exercise Concept Evaluation Programs trials, or real-world contingencies such as peacekeeping, humanitarian and counterterrorism missions, response to natural disasters, and homeland defense.

Description

The FDDMTF provides the insertion of advanced digital and wireless medical technologies and the enhancement of ground and air mobility readiness. This is a Joint effort between the Army and Air Force with a partnership that emphasizes computerized modeling and simulation for dynamic mission-oriented configuration of "just-in-time" service. This system features independent modular configurations composed of both service-specific and service-independent components, vehicles, and personnel packages engineered to reduce weight, cube, and airframe requirements. Additionally, the most critical aspect is that of providing essential care and reach-back capabilities from any deployed location.

Laboratory/Developer

TATRC
U.S. Air Force

Medical Modeling and Simulation (MM&S)

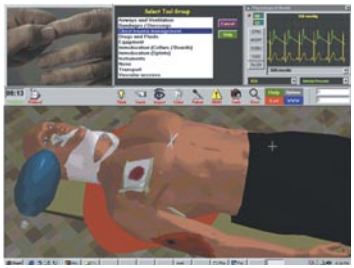
PC-Based Interactive Multimedia: Simulation Technologies for Advanced Trauma Care (STATCare)
Part-Task Trainers
VIRGIL™
Virtual Reality Demo (VR-Demo)
Advanced Ureteroscopic Surgical Training System, Transurethral Resection of the Prostate (TURP)
Dynamic Injury Creation Simulator
Medical Simulation Training Initiative (MSTI)

Mission

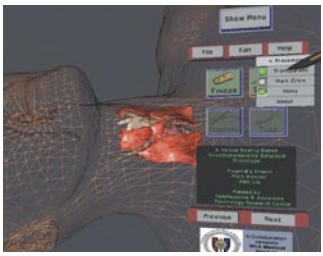
TATRC is spearheading improved training of both military and civilian health care providers by managing the development of simulation technologies and integrating them into medical training systems. These systems will allow health care personnel to practice critical skills on simulated patients and/or in "immersive environments" to create a realistic "look and feel" of patient treatment.

Description

Simulation technologies revolutionized aviation safety and warfighter training. In medicine, simulation technologies offer the potential to train people from the foxhole to the OR. By using simulators that have been embedded into medical curricula to create systems of training, users can develop and sustain their skill proficiency with no risk to real patients. They can gain the confidence required for managing high-risk patient conditions by training in a controlled situation. TATRC is integrating research funded by many sources, e.g., congressionally directed, U.S. Army "core" funding, dual-use, small business innovative research (SBIR), and small business technology transfer (STTR). TATRC's MM&S research portfolio falls into four main areas: personal computer (PC)-based interactive multimedia, digitally enhanced mannequins, part-task trainers (sometimes called virtual workbenches), and total immersion virtual reality.

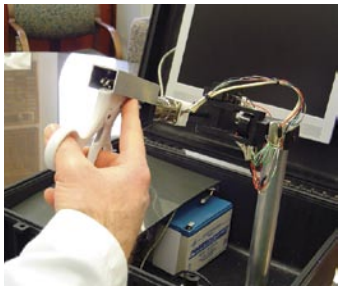


PC-Based Interactive Multimedia. STATCare (by RTI International) is a trauma patient simulator that gives sustainment training for emergency medical technicians (EMTs) on a PC-based interactive multimedia "Virtual Patient." The patient responds physiologically and pharmacokinetically to user diagnosis and treatment. User interaction is recorded for after-action review. With additional funding directed through another agency (Office of the Secretary of Defense for Health Affairs is expanding STATCare's capabilities into Sim-Patient™, also developed by RTI), it will have the capability to simulate multiple patients and provide higher-than-EMT-level training. TATRC has also begun work to develop PC-based "sim games" for CBRNE training.



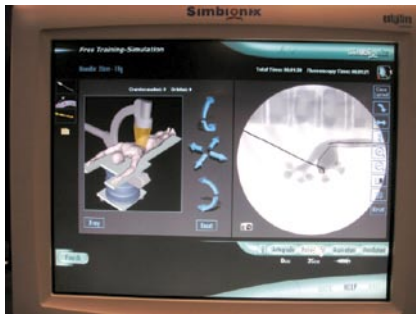
Part-Task Trainers. Much work is ongoing to develop "part-task" trainers that allow training to focus on high-risk, high-consequence parts of clinical procedures. Work is progressing in many procedures, e.g., virtual cricothyroidotomy, needle thoracentesis, central venous catheterization, exsanguinating hemorrhage, fractured femur, and intracranial burr hole. Two new areas of development are Haptics-Optional Surgical Training System and Simulation-Based Open Surgical Training Systems.

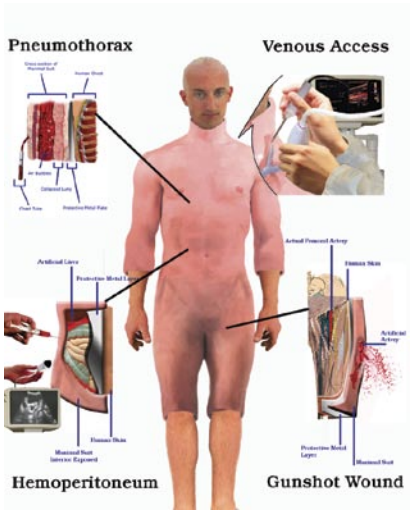
VIRGIL™. The Center for Integration of Medicine and Innovative Technology (CIMIT) Simulation Group is developing this prototype chest trauma training system, which teaches trainees how to diagnose and treat a chest trauma victim in a combat situation. It integrates a hybrid mannequin, virtual reality tools, and a computer-based system and offers several levels of difficulty. In April 2004, VIRGIL™ was selected as one of the Army's 10 Greatest Inventions for 2003. Initial validation studies at the National Capital Area Medical Simulation Center have shown that VIRGIL™ trains third-year medical students "as effectively as pig training."



VR-Demo. Skills degrade over time, may be lost at a moment of need, and/or are needed for the unexpected. The VR-Demo psychomotor skills trainer/tester is a portable, flexible, self-contained haptics-based simulator. It allows training to be moved from the laboratory to the workplace or to field conditions for "just-in-time" training.

TURP. Under SBIR Phase II funding, validation, software, and force feedback research is being conducted to increase training effectiveness. The National Capital Area Medical Simulation Center, together with Emory University, is conducting a comprehensive "VR to OR" validation study on the URO Mentor™ simulator. The main components of the software module and also external software and/or hardware modules as well as their relations to each other were designed. The haptic device was adapted to laser TURP. The interface with the force feedback device was designed at high frequency to maintain a smooth response.





Dynamic Injury Creation Simulator. The Virtual Reality Medical Center is producing a functional, medically and militarily tested prototype of the injury creation simulator to provide a realistic training experience at two levels. For corpsmen embedded with their squads, the goal is rapid initial assessment and stabilization. Medical scenarios will include only wounds that corpsmen address in the field. The medical scenarios for Echelon II will be selected from

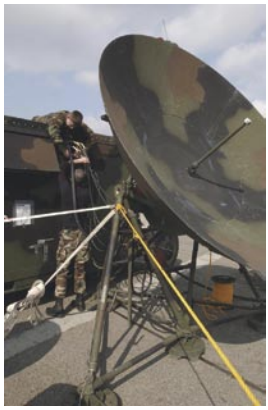
a broader choice of procedures, while still focusing on treatment of injuries for which corpsmen have existing equipment. These scenarios will provide medics and corpsmen with the actual experience in the field that they must master. The training exercises take place under live or simulated fire, complete with "enemy" actors and combatants, explosions, and other special effects. The investigators will bring all the tools of Hollywood special effects to live training, which culminates in a near-real battlefield experience.

MSTI. Looking into the future, the MSTI is a long-term research effort to identify, develop, and integrate fundamental "enabling technologies" into medical simulation devices and even entire medical training systems. The CIMIT Simulation Group is executing the MSTI program. Examples of enabling technologies are tissue properties measurement, tool-tissue interactions, haptics, virtual reality graphics and visualization, learning, and open systems architecture. Under the auspices of this technology development initiative, concepts have been prototyped into products related to computer-based simulation training systems, e.g., VIRGIL™ and SITU (Smallpox Inoculation Training).

TATRC is leading two significant initiatives to pave the way for widespread adoption: validation and open standards development leading to interoperability. TATRC has funded more than a dozen studies to validate the degree to which skills developed via simulation transfer to the delivery of health care. To enhance interoperability among medical simulation systems, TATRC is now facilitating informal discussions to spur development of "open source standards" for medical modeling and simulation.

Laboratory/Developer

TATRC



Medical Surveillance Network

Mission

The Medical Surveillance Network will facilitate data exchange and support all levels of care with an integrated joint medical information system, thereby linking system communications and promoting situational awareness.

Description

The Medical Communications for Combat Casualty Care (MC4)/Theater Medical Information Program (TMIP) is a defense medical surveillance system. The MC4/TMIP conducts medical trend analysis based on data from multiple sources (i.e., environmental survey data; nuclear, biological, and chemical data; patient encounter data; and medical sensor data). This system links to worldwide surveillance resources to include the command and control system for warfighter situational understanding updates.

Laboratory/Developer

MC4
TATRC
TMIP

Special Operations Forces Medical Handbook (SOFMH™)

Mission

A knowledge-based medical assessment and treatment aid will support special operations medics deployed in remote environments.

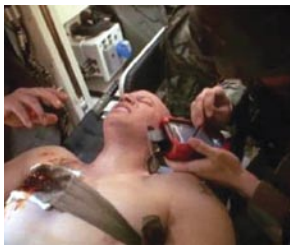
Description

The SOFMH™ is a PDA computer platform that is lightweight, rugged, secure, water/windproof, and capable of day/night readability. This first responder medical record system and digital force health surveillance data collection software is also integrated with training modules containing interactive simulations that support readiness sustainment, medical reconnaissance, medical speech recognition, language translation, medical diagnoses, and treatment of chemical/biological agent casualties.

Laboratory/ Developer

TATRC

Wireless Electronic Information Carrier (EIC)/Personal Information Carrier (PIC)



Mission

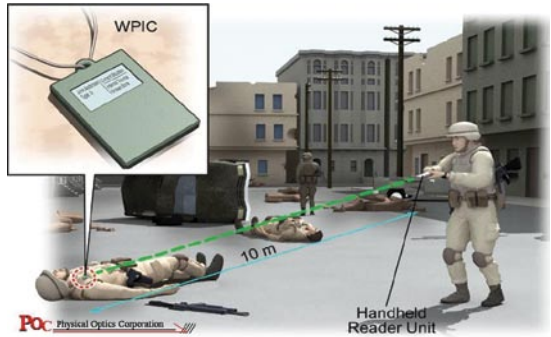
The EIC is integral to "patient-centered" medical data flow on the battlefield. It is intended for issue to each Soldier prior to deployment, pre-loaded with that Soldier's medical history, master problem list, immunizations, etc. It will then serve as a personal medical data storage device for any care provided to the patient from point of injury to CONUS-based medical centers and beyond.

Description

The EIC is a wireless data storage device the size of a dogtag that is capable of storing up to 4 GB of data; however, the real power of the EIC is its ability to securely and wirelessly read and write data within a range of 10 meters of a medical device such as the BMIST and the Composite HealthCare System II-T. It also has a universal physical interface that ensures compatibility with any commercial off-the-shelf/government off-the-shelf IT products as well as its use when wireless communications are not available.

The PIC is an earlier non-wireless version with storage capacities up to 1GB. Like the EIC, it is a rugged, low power consumption, flash memory device that is hardware and operating system independent.

The EIC allows individual medical data to be accessed and updated by medical personnel when real-time connectivity to a database is unavailable. The EIC was chosen as one of the Army's 10 Greatest Inventions for 2004.



Laboratory/ Developer

TATRC

Disaster Relief and Emergency Medical Services (DREAMS)

Mission

Telementoring/telemedicine capabilities will allow earlier interventions in recording patient data and give the medics access to medical information.

Description

The digital emergency medical services (EMS) system integrates digital diagnostic medical equipment, medical informatics software systems, and communications systems. The digital EMS system provides a common user interface, integrated medical equipment, and remote video cameras. A unique and vital aspect is the system's capability to provide real-time patient information, such as vital signs, to a remote physician and, in turn, communicate instructions back to the personnel on site. This also allows medics to refer to treatment protocols or refresher training for any situation.

Laboratory/Developer

TATRC

Emergency Hypothermia and Smart Aortic Catheter

Mission

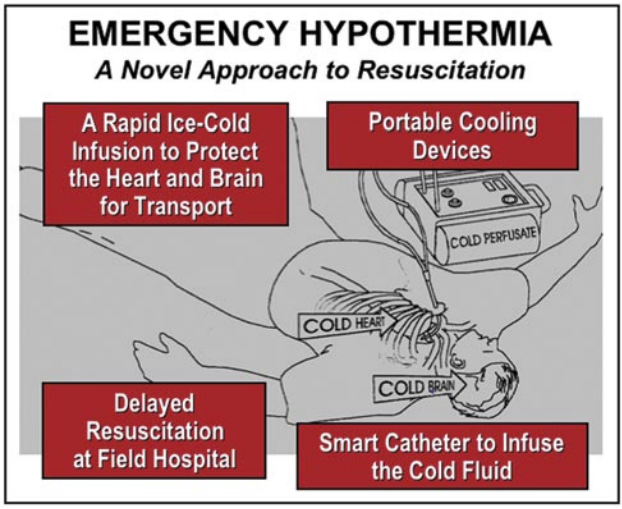
This catheter will help stabilize a casualty's temperature to slow down metabolism during emergency transport to a medical facility.

Description

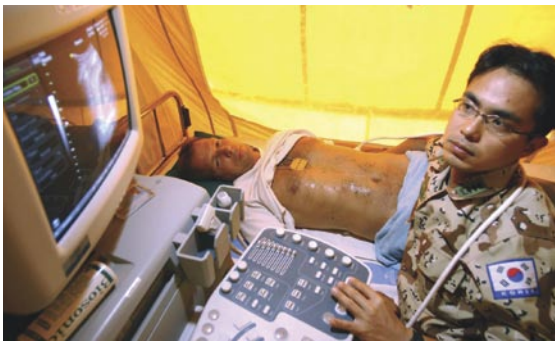
The Emergency Hypothermia and Smart Aortic Catheter induces hypothermia to slow down metabolism. This device is particularly useful in slowing trauma casualty deterioration during evacuation and surgery.

Laboratory/Developer

TATRC



Medical Ultrasound, Three-Dimensional, Portable with Advanced Communications (MUSTPAC 3)



Mission

The medic or a layperson will transmit ultrasonic data in a three-dimensional image for distant review and diagnosis.

Description

The MUSTPAC allows the user to capture ultrasonic information from a conventional ultrasound unit, in the form of a three-dimensional (3D) databank. The device maps standard 2D volume by coupling the ultrasound machine to a mechanical arm providing six degrees of freedom information. The 3D data are forwarded to a radiologist who then uses the virtual probe to "scan" the imaginary patient in any directional plane and make a diagnosis.

The benefits of the portable ultrasound device include the following:

- Digitized data for storage and transmission;
- Data reconstructed into 3D image;
- Image can be rendered in color;
- Permits a layperson to operate the ultrasound unit; and
- Allows for distant review and diagnosis.

Laboratory/Developer

TATRC

Robotic Medic Assistant, Patient Evacuator

Mission

The Robotic Medic Assistant is to be used by combat medic and Soldier-buddy first responders to assist in combat casualty location, assessment, treatment, and extraction and evacuation.

Description

This robotic device can be used in urban terrain and in hazardous or contaminated environments. The device supports Future Combat Systems (FCSs) concepts of mobility, agility, survivability, and sustainment. The vehicle crew can recover a casualty, either manually or mechanically, without the need to dismount and without driving to the casualty.

This robotic patient recovery technology performs multiple missions in hazardous areas, thereby reducing risk to the first responders. The greatest benefit of this technology is that it allows providers to focus on patients.

Laboratory/Developer

TATRC

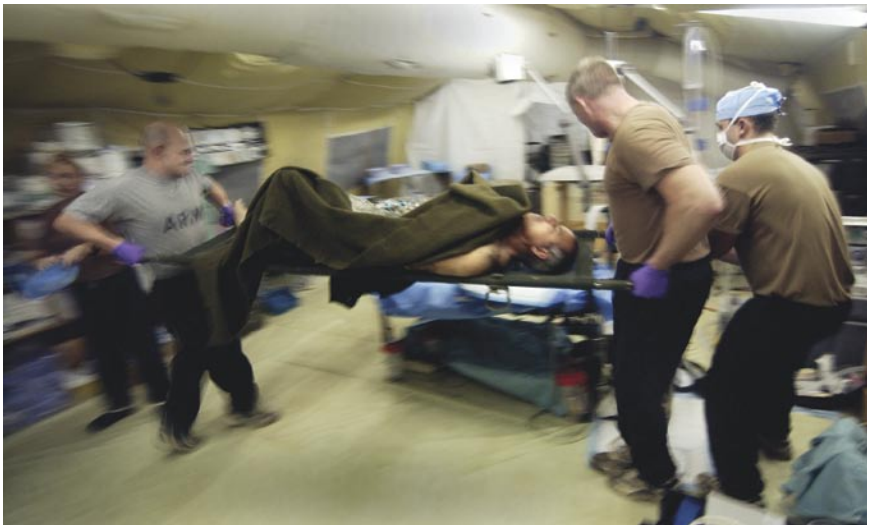
Speech-Capable Personal Digital Assistant

Mission

The Speech-Capable PDA will allow military health care providers to enter data hands-free, thereby allowing focus on the patient.

Description

The PDA is equipped with a directional array miniature microphone system and speech advanced recognition software. Health care providers can perform hands-on medical and surgical procedures at all echelons of care, ranging from combat medic first responders to physicians in tertiary care medical centers.



Laboratory/Developer

TATRC

Virtual Retinal Laser Display

Mission

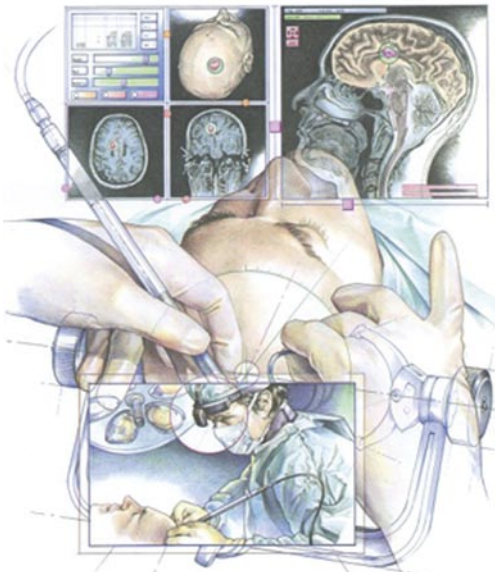
An unobstructed full field of vision of the computer screen for health care providers while performing hands-on medical and surgical procedures is vital for patient treatment.

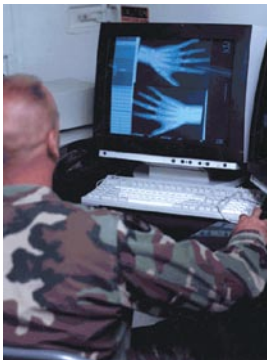
Description

The Virtual Retinal Laser Display technology provides head-, helmet-, headgear-, or eyeglasses-mounted, hands-free, daylight readable computer color display by directing a laser beam containing a computer image directly onto the retina of the eye. This projects vital medical information on the health care provider's retina while treating the patient.

Laboratory/Developer

TATRC



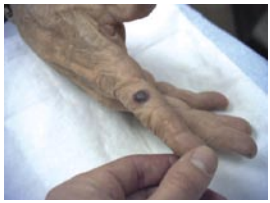


Digital Imaging Network-Picture Archiving and Communications System (DIN-PACS)

- Provides Soldiers and their families with faster and better images to enhance quality of care.
- Made up of several components: re-usable phosphorus plates that work with a normal x-ray machine, a computerized radiography scanner, and a workstation to view captured images. Images can be lightened or darkened, leveled to find best quality, sent off site to a radiologist for diagnostic reading, and archived immediately.
- Completed date: 1991.

Digital Information and Communications System (SMART/MC3T)

- Enables Soldiers to establish communications (e.g., self-sufficient Internet and telephonic coverage) in remote areas and provides local authorities with medical situational awareness and telemedicine services.
- Implements commercially available technologies through a modular solution that is heterogenous, multi-platform, open standards based, and upward-compatible in both capacity and technology.
- Completed date: 2003.



Teleconsultation/ Teledermatology

- Facilitates readiness and promotes health protection of the force.
- Facilitates delivery of medical treatment through information and telecommunication technologies.
- Completed date: 2001.

Active Component Hospital Decrement (ACHD)

Mission

The ACHD will provide the deploying medical force with the latest available technology while mitigating the fiscal impact associated with obsolescence.

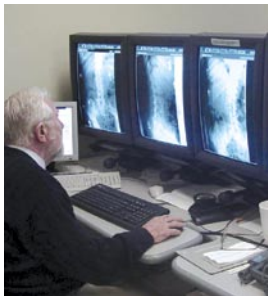
Description

The USAMMA is currently developing a concept known as the Active Component Hospital Decrement to address the management and maintenance of selected items of modernized medical equipment and special purpose test, measurement, and diagnostic equipment (TMDE). USAMMA has acquired and fielded a number of these items to the deploying force for both Operation Iraqi Freedom and Operation Enduring Freedom. This equipment was selected by an AMEDD clinical team during the planning for Operation Iraqi Freedom.

The goal of the program is to ensure appropriate equipment items are ready for deployment to meet the requirements of the force. The ACHD serves as an umbrella program, encompassing equipment authorized by units and as a part of programs such as the Reserve Component Hospital Decrement, Hospital Optimization Standardization Program, and Army Pre-positioned Stocks.

Laboratory/ Developer

USAMMA

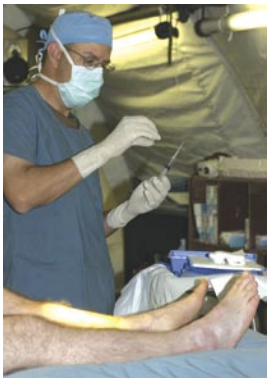


Army PACS Program Management Office (APPMO)

- Develops Picture Archive and Communications Systems (PACS), teleradiology, and other medical imaging systems as they evolve.
- Continuously assesses the state of fielded PACS imaging systems, modernizes and upgrades new clinical features for customers, and enhances security of the products. Manages configuration control, ensures successful integration and interoperability, and works closely with other services and the Military Health Service to synergize and leverage acquisition and maintenance savings for these products.
- Completed date: Ongoing.

Cold Chain Management

- Protects the Soldier by managing and coordinating the distribution of temperature-sensitive medical products in critically short supply from the manufacturer to the first-level user.
- Ships packages in validated containers that include temperature-monitoring devices, moves products rapidly, and has key involvement with knowledgeable customers.
- Completed date: Ongoing.



Combat Support Equipment Assessment (CSEA)

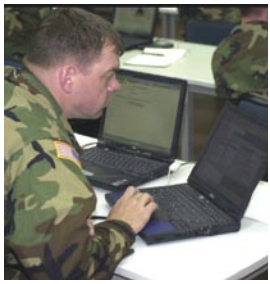
- Provides information to senior decision makers regarding new equipment and technology in field medical treatment facilities.
- Provides quality assurance of the acquisition and sustainment process and provides guidance to help eliminate equipment obsolescence.
- Completed date: Ongoing.

Equipment Maintenance and Repair

- Maintains and repairs equipment for use by U.S. forces.
- Manages and operates the repair parts program for field medical units, develops doctrine and policies for maintaining medical materiel, and publishes interactive electronic technical manuals.
- Completed date: Ongoing.

Sample Data Collection Program (SDC)

- Responds to changes in medical technology in a timely manner and identifies significant trends in the maintenance of medical equipment through a comprehensive data collection and analysis program.
- Maintains a database of targeted medical equipment used from Level I Treatment (on the battlefield) through Level III Treatment (Combat Support Hospital) environments.
- Completed date: Ongoing.



Technology Assessment and Requirements Analysis (TARA)

- Provides information via database analyses to senior decision makers at Army military treatment facilities and the U.S. Army Medical Command (MEDCOM) for accomplishing missions and developing acquisition strategies to optimize clinical outcomes.
- Allows 5-year budget requirements to be aggressively managed with front-loading of medical care support equipment and super capital expense equipment program requirements for routine replacement of diagnostic-imaging, laboratory, and patient monitoring systems. Resulting process improvements through the generation of requirements and delivery of services have generated a cost avoidance of about $1.6 million per facility since 1995.
- Completed date: Ongoing.

USAMMA Revolution in Logistics (URL)

- Improves business practices through employment of an enterprise resource planning system based on the same software product as the Army's Logistics Modernization Program and DoD's Business Systems Modernization Program. Employs an integrated business information warehouse capability to provide USAMMA and stakeholders with highly detailed reports to support the dynamic changing medical mission.
- Optimizes and modernizes medical logistics business practices. Employment of the URL has achieved a $13 million cost avoidance and reduced customer wait time for medical assemblages from 18 months to an average of 2 months.
- Completed date: Ongoing.

Coding Compliance Editor (CCE)

Mission

CCE will replace the legacy system "Encoder Grouper" to improve the accuracy of clinical information, promote correct billing, reduce the risk for noncompliance, trend clinical performance, and improve revenue generation.

Description

CCE offers integrated clinical coding references, such as Medicare guidelines, powerful search capabilities for code look-ups, and logic decision trees to select codes at the applicable level of specificity. These products also complement military treatment facility (MTF)-Level Coding Compliance Programs by identifying patterns in coding and automating the pre-billing monitoring of outpatient claims data based on regulatory edits of industry standard local medical review policies for medical necessity, Outpatient Coding Edits and Correct Coding Initiative edits, such as "Code Pairs" and "Bundling" edits, in addition to "Global Periods" for billing of services. CCE also has the ability to identify enterprise-specific edits. These functions enhance coding accuracy, allow for better auditing of patient records, and provide productivity and management reporting capabilities as well as "real time" status of population health based on coded records. CCE will consist of inpatient and outpatient modules.

USAMITC's role is in the implementation process. CCE is in limited deployment at two MEDCOM sites pending a worldwide deployment decision.

Laboratory/Developer

USAMITC

Composite Health Care System II (CHCS II) Deployment

Mission

CHCS II will provide a medical/dental longitude electronic health record for all DoD beneficiaries that can be accessed by health care workers at any DoD health care facility.

Description

CHCS II was designed to meet the challenge of making medical and dental records immediately available to providers caring for a highly mobile population that includes 1.4 million active duty Armed Service members around the world. The system provides authorized users with secure electronic access to a DoD beneficiary's comprehensive health record, which includes data on preventive care, illnesses, injuries, and exposures treated at any MTF. All CHCS II users will have access to any eligible beneficiary's medical/dental record within seconds from any MTF in the world. CHCS II is designed to create the patient record as part of the process of providing care during a treatment encounter thus reducing duplicative tasks such as documentation, order entry, and consults.

CHCS II is developed and deployed in blocks. When complete, it provides detailed in- and outpatient records with appointment/order entry/consult capabilities, a windows front end for easy navigation, worldwide access to all medical data, integrated clinical practice guidelines, population health capabilities (at the provider, clinic, MTF, and corporate level), preventive medicine capabilities such as patient-specific health reminders and alerts, automated coding, and patient safety information.

USAMITC is providing implementation support. Currently, almost half of the 35 MEDCOM facilities planned have been completed or are in process.

Laboratory/Developer

USAMITC

Defense Medical Human Resources System-internet (DMHRSi)

Mission

DMHRSi will simplify and standardize medical human resource (HR) management and manpower reporting and replace legacy systems to include UCAPERS (Uniform Chart of Accounts –Personnel Utilization System) used by MEDCOM.

Description

DMHRSi is a web-based tri-Service system that is designed to simplify and standardize HR management. DMHRSi enables the Military Health System (MHS) to optimize all HR – military, civilian, volunteer, contractor, assigned, or borrowed personnel – and to standardize the capture and measurement of HR costs across the enterprise. DMHRSi tracks essential HR information to support personnel, manpower, labor cost assignment, personnel readiness, and education and training. DMHRSi provides functional capabilities that significantly enhance the management of HR information for improved decision making at all levels of the MHS.

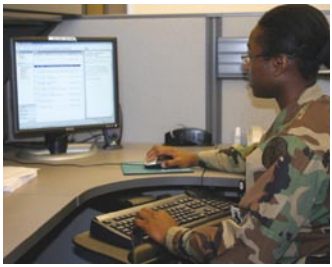
DMHRSi increases the visibility of medical personnel and placement, enables self-directed customer service, provides decision-making information for personnel use, facilitates easy identification of medical personnel readiness status, and enhances personnel planning and cost management. Additional capabilities include facilitating accurate recording and reporting of labor hours and workload costs, supporting the management of training portfolios, and enabling online registration and approval of training courses.

USAMITC is assisting with the implementation of this system. DMHRSi is in limited deployment at three MEDCOM sites pending worldwide deployment decision.

Laboratory/Developer

USAMITC

Enterprise Web Farm (eWeb Farm)



Mission

The eWeb Farm will provide enterprise class value-added web-hosting services that are managed in compliance with government policies, procedures, and guidelines to encourage AMEDD customers to host applications centrally rather than locally.

Description

This project was initiated so customers could turn over the time-consuming responsibility of managing an infrastructure service such as web hosting, thus freeing critical IT resources to concentrate on supporting patient care systems and their users. Operational needs addressed by the hosting service include providing a reliable, secure, scalable, fault-tolerant, policy-compliant web-hosting environment where hosted applications:

- Are managed and monitored according to individual needs,
- Are backed up daily and weekly and retained off site for 3 weeks, and
- Are proactively patched for compliance to Information Assurance Vulnerability Alert (IAVA) requirements.

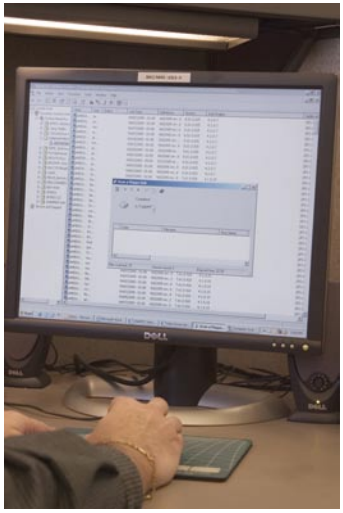
The eWeb Farm will provide hosting services for websites and applications that run on Microsoft Internet Server (IIS) or Apache HTTP Services. Applications that require database systems are supported through clustered Microsoft SQL Server 2000 Enterprise or Oracle 9i database management systems.

Centralizing web-hosting services will allow the AMEDD to take advantage of economies of scale and eliminate redundancies that will result in a lower cost, while at the same time improving the organizations' posture for security, proactive management, disaster recovery/business continuity, scalability, and manageability.

Laboratory/Developer

USAMITC

Information Assurance Vulnerability Management (IAVM)



Mission

The DoD faces the ongoing challenge of securing its networks and computer systems from external threats such as viruses and hackers. The USAMITC-Information Assurance (IA) Office is responsible for facilitating the management of these risks and vulnerabilities for the MEDCOM through IAVM.

Description

Through this process, the USAMITC-IA Office ensures computers, applications, and networks run unabated. Vulnerability management includes notifying system administrators, IA security officers, and all appropriate staff of the vulnerability. In addition, the office informs the responsible parties to access the Army Asset & Vulnerability Tracking Resource to acknowledge the receipt of the notification and report the number of systems affected.

IAVM will also ensure that the administrators assess the impact of the vulnerability; apply the corrective system patch or required fix or submitting a Mitigation Action Plan (MAP) if corrective actions cannot be implemented within the specified timeframe; and report the status for each vulnerability notice as it applies to every applicable asset within its area of responsibility. The USAMITC-IA's official response is through weekly updates to the USAMRMC, who in turn compile the information for the MEDCOM.

Additionally, IAVM will conduct random compliance checks (scans) on assets to validate the information being reported through the command channels.

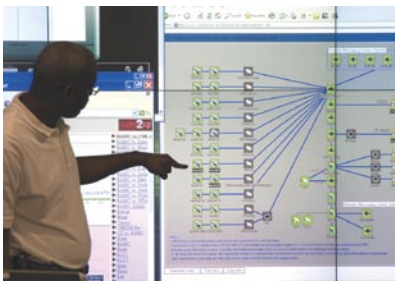
Laboratory/Developer

USAMITC

AMEDD Enterprise Service Center (AESC)

Mission

The AESC will be a key enabler to providing IT services managed at the enterprise level with a netcentric view. The AESC will monitor the AMEDD infostructure 24/7 to include networks, servers, and end user devices.



Description

The AESC serves as USAMITC's crisis center and support center for MEDCOM enterprise IT operations. The huge video wall and associated feeds afford USAMITC staff the ability to monitor the health and welfare of the MEDCOM enterprise infrastructure and the systems that ride on that infrastructure by providing a real-time lens to view and monitor the infostructure.

Using push technology and enterprise management tools, information can be projected on the video wall to warn engineers of potential problems and give them lead time to avert the problems or help them resolve problems that could not be averted. Some tools also assist in checking IAVA compliance to enhance the enterprise security posture and ability to ensure the integrity of protected health information.

Because the AESC is co-located with the Centralized Help Desk, information flows easily between network engineers and help desk technicians. When users call, the help desk technician will probably already be aware of the problem and can inform the user that the issue is being worked.

As resources are enhanced, trend analyses will allow the MEDCOM to make informed decisions on ways to better utilize existing infrastructure or justify upgrades. The USAMITC can also identify, diagnose, and correct potential problems in the delivery of IT services to the MEDCOM enterprise before they occur or reduce their impact to the user community when problems cannot be averted, moving from a reactive mode to a pre-emptive mode.

Laboratory/Developer

USAMITC

Centralized Help Desk (CHD)

Mission

The CHD will implement a single suite of advanced enterprise-level processes and software/hardware tools that empower help desk support personnel to provide world-class help desk services.

Description

The MEDCOM desires to consolidate and centralize help desk services by standardizing help desk processes and software tools and by using fewer contract/services agreements across the command. USAMTIC will provide centralized help desk services for its enterprise systems throughout the AMEDD. The CHD project is a systematic, multiphase effort to enhance help desk services to an industries best practices level. The project will standardize processes in configuration management of the IT service desk, incident management, problem management, change management, and release management.

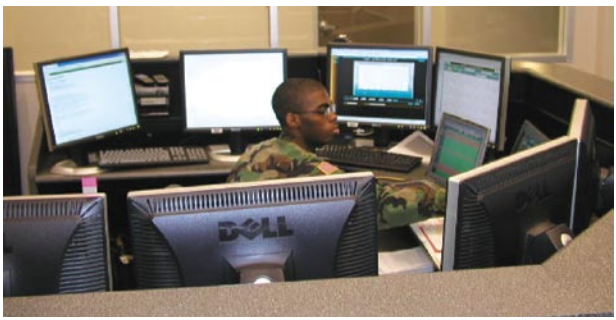
Laboratory/Developer

USAMITC

MEDCOM Enterprise Management (MEM)

Mission

The MEM project will deploy systems and software that will allow monitoring of the health of servers, desktops, networks, security devices and other components of AMEDD health care systems and provide the capability to remotely deploy software upgrades, such as new software releases and IAVA patches, to servers and desktops.



Description

The MEM provides the systems and tools necessary to monitor, manage, and secure the IT environment that provides patient care for the AMEDD and enables senior leadership to have a real-time status of critical IT health care systems. MEM systems provide the overarching management tools for all information gathering of IT systems across MEDCOM to strengthen network security, upgrade system management, consolidate and reduce resources, centralize administrative functions, and provide a lower total cost of ownership for IT service.

The MEM will use a portfolio of tools to deploy security patches across the AMEDD down to the desktop level through a remote site, thereby reducing time and resources needed to upgrade and secure systems. All critical applications and health care servers can be monitored on a continuous basis ensuring higher levels of patient care and response. Additionally, all users are provided with meaningful information on the status of the systems in accordance with the AMEDD mission.

Laboratory/Developer

USAMITC

Theater Trauma System (TTS)

Mission

The TTS goal is to provide the right care to the right casualty at the right location and right time (R4).

Description

The TTS is an AMEDD implementation and adaptation of the civilian trauma system counterpart for the battlefield.

The TTS will improve battlefield trauma care capabilities by planning and integrating key components to ensure and improve R4. Those key components are as follows: leadership, pre-hospital care, information systems, clinical practice guidelines, research and quality assurance, and process improvement. A key objective will be the electronic collection and dissemination of critical patient data throughout all levels of care and supporting a longitudinal health record. The DoD Health Affairs directed establishment of a Joint Theater Trauma Registry to facilitate medical analysis and research for improvement or clinical practices, standard operating procedures, strategic studies, and other reports to help improve the Army's medical care of its warfighters. One such report is the vice chief of staff of the Army-directed investigation into body armor effectiveness. The other components can be accomplished by integrating a trauma medical director at division level, integrating pre-hospital and hospital delivery of care, standard clinical practice guidelines, morbidity and mortality information, integration of common databases, communication of patient data across levels of care, and strategic and tactical medical research.

Laboratory/Developer

USAMITC

Third-Party Collections Claims (3pc)

Mission

The 3pc will enhance the Army's ability to collect disputed third-party collection claims from numerous insurance companies.

Description

The 3pc system is a web-based application designed to enhance the Army's ability to collect on disputed insurance claims from various companies. The SQL database will include 6 years of delinquent accounts currently located in the CHCS and in the Third-Party Collections System (TPOCS) in addition to the associated paper documents currently located at 38 MTFs worldwide. After these data are aggregated into a central database, it will be accessible by one or more contracted collection agencies and a team of litigators, who will collect on unpaid accounts through best practice collection procedures and litigation processes, respectively.

An extraction module gathers data from CHCS and TPOCS and periodically forwards the data to the 3pc centralized database, which stores the disputed claims data, accounts receivables, collections work product, and other supporting claims documentation. The 3pc web interface then provides secure access to the centralized database via a role-based permission structure.

There are also data mining tools and reports that can be used to analyze collection trends and processes. The 3pc also provides the ability to control the disputed claims currently in process by the contracted collection agency and allows the generation of consolidated demand letters and other collections documentation (i.e., legal notices).

Laboratory/Developer

USAMITC

(UEx) Unit of Employment and (UEy) Unit of Employment

Mission

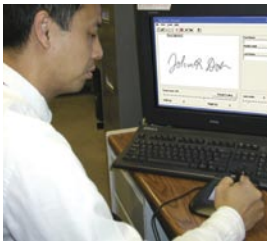
USAMITIC will provide DoD Architecture Framework Systems Views that integrate the MEDCOM into the UEx, the command and control echelon within the Army Objective Force (2010), and into the UEy. The UEy must be able to receive, coordinate, and employ a varying mix of UEx and Brigade Combat Teams (BCTs), interact with other UEys around the globe, and be tailorable to support a Joint Task Force (JTF)/Coalition Forces Land Component Command headquarters element.

Description

Systems Architecture (SA) is the foundation for bridging enterprise business tasks and activities to systems capabilities. Integrated with Operational Architecture and Technical Architecture, AMEDD SA enables Army medical units to provide superior health care across the Joint area of operations. USAMITC is teaming with the AMEDD Directorate of Combat and Doctrine Development and TRADOC Architecture Integration and Management Directorate to produce the initial set of Systems Views comprising the SV-1 (Systems Interface Description), the SV-2 (Systems Communication Description), and the SV-6 (Systems Data Exchange Matrix).

Laboratory/Developer

USAMITC



AMEDD Electronic Forms Support System (AEFSS)

- Developed for use with Adobe FormFlow Filler 2.3.5 and Silanis ApproveIt 5.6.9 electronic signature software. Can be installed on Novell or Microsoft Windows file servers or standalone PCs. Creates a corporate standard and ensures all users are working with the same version of forms.
- Provides AMEDD users easy access to all electronically driven forms and documents. Allows integration of forms management with corporate e-mail system to automate, streamline, and accelerate workflow processes.
- Completed date: Ongoing.

Automated Pre/Post-Deployment Health Assessment (P/PDHA)

- Ensures that health problems emerging during deployment are properly documented and addressed by electronically capturing and storing health state information of military personnel before, during, and after major deployments.
- Incorporates four modes of operation (Internet, intranet, standalone, and medical PDA) with a secure login and password protection.
- Completed date: Ongoing.

Defense Medical Logistics Standard Support (DMLSS) Deployment

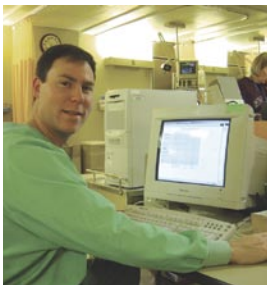
- Standardizes medical logistics systems used by DoD's Uniformed Services medical facilities by making logistics more user friendly and less labor-intensive and supplies more readily available.
- An integrated system developed to accommodate the needs of the Army, Navy, and Air Force at the wholesale and retail levels for medical logistics support at fixed MTFs and for deployed theater forces. Provides materiel management, facility management, and equipment and technology management capabilities to its users.
- Completed date: 2005.

Electronic Freedom of Information Act (eFOIA)

- Supports MEDCOM FOIA requests and processes using the FOIAXpress System.
- Provides an electronic document management system capable of scanning and storing documents in electronic formats. Also provides the capability to redact information stored electronically and to transfer such information between integral components of the MEDCOM. Includes the ability to provide a public website to allow requesters to submit, track, and receive FOIA requests and an "Electronic Reading Room" to display frequently requested information.
- Completed date: Ongoing.

Network Operating System and Electronic Messaging (NOS EM) Project

- Upgrades existing network operating systems and e-mail system for the AMEDD to allow for better security, server reduction and consolidation, and centralized administration. Consolidates e-mail service into one of six global message centers. Centralizes management and administration functions for the AMEDD Active Directory systems and Exchange 2003 e-mail administration.
- Allows the AMEDD to receive continued vendor support for its primary server operating system, which is critical to security at the enterprise level.
- Completion date: Ongoing.



Surgery Scheduling System (S3)

- A web-based OR scheduling tool that manages surgical cases from beginning to end, is easy-to-learn and use, implements security access at various levels, and lends itself easily to expandability. Permits access from any location in the hospital. Allows scheduling of anesthesia/nursing staff, storage of default values for procedures, retrieval of CHCS patient demographic data, audit tracking, metrics reporting, use of preference cards, use of ICD-9 and CPT codes, and much more.
- Improves overall OR utilization efficiency for military hospitals. An interim solution until the Enterprise-Wide Scheduling–Registration system is fielded in 2007.
- Completion date: 2004.

Video Network Center (VNC)

- An audio and videoconferencing bridge for the AMEDD and other tri-Services. Provides an average of 277 multipoint videoconferences per month and more than 4,500 videoconference hours per month, as well as technical support and assistance in acquiring or upgrading audio or video conferencing capabilities.
- USAMITC's customer base of over 1,700 certified sites includes various participants within the DoD and key civilian communities who use videoconferencing to improve operational effectiveness and productivity in serving the health needs of the Soldier.
- Completion date: Ongoing.

Emerging Facility Markets/Enhanced Use Lease (EUL)

Mission

The EUL will leverage underused Army assets to provide world-class medical and medical research facilities for the AMEDD.

Description

In FY 2001, the DoD obtained expanded EUL authority, established by the National Defense Authorization Act, which gives individual military base commanders greater ability to lease unused or underused real estate for cash or in-kind services. Specifically, installations can (among other activities):

- Enter into long-term or short-term leases, providing greater flexibility for facility use and reuse; and
- Receive cash or in-kind consideration for income on leased property, which can be used for alteration, repair, improvement of property or facilities; construction or acquisition of new facilities; lease of facilities; or facilities operation support.

The EUL concept offers base commanders and DoD numerous benefits: It enhances mission performance through cooperative efforts with public/private partners; improves property use; reduces base operating costs through improved business practices; stimulates the local job market; fosters cooperation between the military services and the private sector; and introduces valuable federal property into the local job market.

Current Army EUL projects include Building 50 at the Walter Reed Army Medical Center (laboratory, office, parking garage, and amenity spaces such as museum and conference center).

Laboratory/Developer

USAHFPA

Emerging Facility Markets/Technologies

Mission

This effort will operationalize health facility planning to recapitalize medical research facilities, applying alternative business and acquisition processes, and emerging facility technologies.

Description

These lead initiatives will recapitalize the existing Army medical research and biodefense laboratory inventory, shaping and improving facilities so science can respond quickly and efficiently to the ever-changing face of military medical research.

The efforts will identify and use alternative business practices to leverage private industry capital in the development of Army facility projects (see Emerging Facility Markets/Enhanced Use Lease entry). Emerging facility technologies are researched and incorporated into the Army health care facility life-cycle management process.

Laboratory/Developer

USAHFPA

Facility Master Planning and Programming

Mission

This capability will determine the resourcing strategy and acquisition methodologies to provide the right facility, at the right place, at the right time for the AMEDD.

Description

Facility Master Planning and Programming assists medical organizations in developing their strategic business plans through market analyses, research, and on-site consulting. Planning and programming bring a unique corporate view: AMEDD-wide best practice insight, system-wide assessment and evaluation, private industry collaboration, and space management to assist organizations with successful planning.

Laboratory/Developer

USAHFPA

Product Status: **PROMISING** ◆ FUTURE ◆ COMPLETED

Subcategory: ***Health Care Facilities***

Medical Facility Military Construction (MILCON) Program

Mission

The MILCON Program replaces or recapitalizes AMEDD facilities to provide world-class platforms for health care delivery, medical research, and support operations.

Description

The USAHFPA partners with the U.S. Army Corps of Engineers, supported medical staff, architecture/engineering firms, construction contractors, and other stakeholders to design and construct medical facilities that are appropriately sized for the current mission, yet flexible enough to adapt to future change.

The following projects are currently under construction:

- Bassett Army Community Hospital Replacement, Fort Wainwright, Arkansas;
- 121 General Hospital Addition and Alteration, Yongsan, Korea;
- Darnell Army Community Hospital Emergency Department Addition and Alteration, Fort Hood, Texas;
- Consolidated Troop Medical Clinic, Fort Stewart, Georgia;
- Health Clinic Addition and Alteration, Wiesbaden, Germany; and
- Veterinary Care Instructional Facility, Fort Sam Houston, Texas.

Projects currently under design are as follows:

- Dewitt Army Community Hospital Replacement, Fort Belvoir, Virginia;
- Consolidated Health Clinic, Fort Benning, Georgia;
- Health/Dental Clinic Addition and Alteration, Grafenwoehr, Germany; and
- Troop Medical Clinic #10, Fort Hood, Texas.

Laboratory/Developer

USAHFPA

Medical Facility Renewal Program

Mission

Optimize resources by renewing existing facility infrastructure to provide world-class medical facilities for the AMEDD.

Description

The Renewal Program leverages integrated design and construction methodologies and operational funding to restore obsolete infrastructure systems and to modernize the functionality of the facility while updating to current codes, standards, and modern health care operations. The project integrator leads a team of members from the USAHFPA, Corps of Engineers, and civilian contractors through the planning, design, and restoration of the facility, as part of the MEDCOM Facility Capital Investment strategy.

Laboratory/Developer

USAHFPA

Special Medical Augmentation and Response Teams – Health Systems (SMART-HS)

- Provides deployable health facilities expertise worldwide to support the AMEDD's health care mission. Augments medical forces with health facilities expertise across the full spectrum of operations, providing medical facility assessments and assistance; engineering, architectural, equipment, and health care infrastructure consulting; and project design, construction, and management.
- Develops the medical infrastructure in the maturing theater, supports reestablishment of civilian medical infrastructure, and acts as the liaison with engineering units and staffs.
- Completion date: Ongoing.

Appendix A

Licensed Technologies and Patents

Provided in this appendix are two lists regarding USAMRMC-developed technologies. The first is a summary of patent license agreements, and the second is a listing of patents issued to the laboratories.

Patent License Agreements with USAMRMC Laboratories[1]

The following list highlights technologies developed in USAMRMC laboratories that have been licensed to commercial entities for further development or production.

Execution Date	Title of Patent [and/or licensed technology]	Patent Number
1/21/1983	Licensed a Non-patented Compound [Halofantrine]	none
9/8/1986	Immunologically Active Peptides Capable of Inducing Immunization against Malaria and Genes Encoding Therefor	4,707,357
10/14/1987	Hybridoma Cell Lines and Monoclonal Antibodies to *Clostridium difficile* Toxins A & B	5,071,759
8/19/1991	Polypeptides Selectively Reactive with Antibodies against Human Immunodeficiency Virus and Vaccines Comprising the Polypeptides	6,248,574
3/30/1992	Computer Driven Amino Acid Indexer for Peptide Synthesis	5,243,540
5/12/1992	Novel Antimalarial Dihydroartemisinin Derivatives	4,791,135
3/25/1993	Method for the In Vitro Production of Proteins from a DNA Sequence without Cloning. Expressing Polymerase Chain Reaction (E-PCR) Technique	07/609,318 08/085,241
1/5/1995	Absorbable Tissue Adhesives	5,350,789
5/1/1995	Immuno-potentiating Systems for Preparation of Immunogenic Materials [Nasal Vaccine Delivery System]	5,726,292 3 patents
9/20/1995	Nucleotide Sequences Encoding the Expression of Hantaan Virus Nucleocapsid Protein and the G1 & G2 Glycoproteins	5,298,423
12/8/1995	4-Methyl-5 (Unsubstituted and Substituted) Phenoxy-2,6-Dimethoxy-8-(Aminoalkylamino) [Tafenoquine]	4,617,394
12/8/1995	4-Methyl-5 (Unsubstituted and Substituted) Phenoxy-2,6-Dimethoxy-8-(Aminoalkylamino) Quinolines [Sitamaquine-Antimalarial Drug]	4,431,807

Execution Date	Title of Patent [and/or licensed technology]	Patent Number
3/1/1996	Drug Releasing Surgical Implant or Dressing Material	5,972,366
3/29/1996	Process for Making Liposome Preparation	6,007,838
6/20/1997	Improved Liposome Formulations	5,820,880
8/27/1997	Composition and Methods of Treating Hepatitis C	5,849,696
9/8/1997	Immunological Compositions	6,110,492
9/24/1998	Attenuated Japanese Encephalitis Virus Adapted to Vero Cell and a Japanese Encephalitis Vaccine	6,309,650
12/21/1998	Alphavirus RNA Replicon Systems [Replicon Vaccine Delivery System]	4 patents
4/19/2000	Method of Lysing Thrombi [Blood Clot Lysis Device]	5,399,158
4/19/2000	Advanced Surgical Suite for Trauma Casualties [Medical Surgical Shelter]	5,916,096
6/26/2000	Method for Treating Antibiotic-Resistant Infections	5,965,572
4/3/2001	Multivalent Dengue Virus Vaccine	6,638,514 6 patents
4/16/2001	Transdermal Delivery System for Antigen [Transcutaneous Vaccine Delivery]	2 patents
3/4/2002	Taqman Internal Positive Control [PCR Reagents and Controls]	60/361,455
6/21/2002	Critical Care Platform for Litters [Platform for Medical Monitors]	6,493,890
9/20/2002	Topical Skin Protectants	5,607,979
5/22/2003	Antibodies against Type A Botulinum Neurotoxin	6,667,158
10/7/2003	Asporogenic *B. anthracis* Expression System	6,316,006 2 patents
11/13/2003	High Level Expression of Enterotoxigenic *Escherichia coli* (ETEC) Colonization Factors in DME Broth	60/453,956
12/1/2003	Method for the Production of Purified Invasin Protein and Use Thereof	09/830,025
12/15/2003	Supplemented and Unsupplemented Tissue Sealant, Methods of Production	6,054,122
5/28/04	Automated Inhalation Toxicology Exposure System	09/919,741
6/2/2004	Commercial Development	none
6/15/2004	Battlefield Information System-Telemedicine (BMIST)	10/438,327
9/10/2004	Automated Biomonitoring of Water	6,058,762

[1] List as of March 2, 2005

Patents Issued to USAMRMC Laboratories[2]

The list that follows is a summary of the patents issued to USAMRMC laboratories. A "*" after the patent number indicates the patent has expired.

Date Issued	Title of Patent	Patent Number
	Letterman Army Institute of Research	
7/24/1984	Surgical Retaining Device	4,461,284*
9/25/1984	Preparation of Stroma-free, Non-heme Protein-Free Hemoglobin	4,473,494*
9/25/1984	Intramolecularly Crosslinked Hemoglobin	4,473,496*
	U.S. Army Aeromedical Research Laboratory	
7/31/1990	Ultra Ultrahigh Burning Rate Composite Modified Double-Base Propellants Containing Porous Ammonium Perchlorate (Wallace Computer Services)	4,944,816*
6/11/1991	Method of Ejecting an Interceptor Missile from Its Silo	5,022,306*
12/28/2004	Low-Backscatter Apperture Structure	6,834,971
	U.S. Army Biomedical Research and Development Laboratory	
6/12/1984	Portable Reclining Examination Chair	4,453,768*
12/6/1988	Collapsible Insect Trap	4,788,789*
7/17/1990	Semi-micro Manipulators	4,941,631*
10/2/1990	Atmospheric HCL Monitor	4,960,496*
6/29/1993	X-ray Cassette Holder and Positioning Device	5,224,148*
12/27/1994	Portable Surgical Table	5,375,276*
	U.S. Army Center for Environmental Health Research	
5/9/2000	Apparatus and Method for Automated Biomonitoring of Water Quality	6,058,763
5/28/2002	An Apparatus and Method for Automated Biomonitoring of Water Quality	6,393,899
	U.S. Army Institute for Dental Research	
1/20/1987	Polyactic-polyglycolic Acid Co-polymer Combined with Decalcified Freeze-Dried Bone for Use as a Bone Repair Material	4,637,931*

Date Issued	Title of Patent	Patent Number
	U.S. Army Institute of Surgical Research	
7/5/1983	Protective Gel Composition for Treating White Phosphorus Burn Wounds	4,391,799*
7/12/1983	Protective Gel Composition for Treating White Phosphorus Burn Wounds	4,393,048*
4/6/1993	Anti-microbial Mafenide-Phosphanilate Compound, Pharmaceutical Compositions and Method of Use Thereof	5,200,402*
11/7/2000	Self-Piercing Pulse Oximeter A Assembly	6,144,867
3/20/2001	Medical Monitor Chassis	D439,388
6/5/2001	Biomedical Data Recorder Chassis	D443,062
6/26/2001	Disposable Pulse Oximeter Assembly and Protective Cover Therefor	6,253,098
7/3/2001	Pulse Oximeter Sensor Combined with a Combination Oropharyngeal Airway and Bite Block	6,256,524
7/17/2001	Method for Monitoring Arterial Oxygen Saturation	6,263,223
7/24/2001	Nasopharyngeal Airway with Reflectance Pulse Oximeter Sensor	6,266,547
10/22/2002	Pacifier Pulse Oximeter Sensor	6,470,200
12/17/2002	Critical Care Platform for Litters	6,493,890
2/4/2003	Method and Apparatus for Power Doppler Ultrasound Image Analysis	6,514,208
3/18/2003	Catheter Securing Device and Bite Block	6,533,761
5/20/2003	Syringe Holder Attachment for Medication	6,565,054
8/26/2003	Orthogonal Arterial Catheter	6,610,045
2/24/2004	Wound Dressing System	6,695,824
3/23/2004	Device for Upper Extremity Elevation	6,708,935
6/29/2004	Securing Device for an Endotracheal Tube	6,755,191
1/18/2005	Critical Care Platform for Litters	6,842,922
	U.S. Army Medical Command	
6/22/2004	Portable Medical Digital Radiographic Assembly	6,754,306
	U.S. Army Medical Research and Materiel Command	
11/17/1987	Dermal Substance Collection Device	4,706,676
4/11/1989	Dermal Substance Collection Device	4,819,645*
10/2/1990	Dermal Substance Collection Device	4,960,467*
7/16/2002	Convertible Patient Isolation Pod (Telemedicine and Advanced Technology Research Center)	6,418,932
12/30/2003	Neurocognitive Assessment Apparatus and Method	6,669,481

Date Issued	Title of Patent	Patent Number
	U.S. Army Medical Materiel Agency	
7/16/2002	Convertible Patient Isolation Pad	6,418,932
	U.S. Army Medical Research Institute of Chemical Defense	
12/14/1999	Site-Directed Mutagenesis of Esterases	6,001,625
6/25/2002	Active Topical Skin Protectants Using Combinations of Reactive Nanoparticles and Polyoxometalates on Metal Salts	6,410,603
6/25/2002	Active Topical Skin Protectants Containing OPAA Enzymes and Clecs	6,410,604
7/2/2002	Active Topical Skin Protectants Containing Polyoxometalates and/or Coinage Metal Complexes	6,414,039
7/9/2002	Active Topical Skin Protectants Using Hybrid Organic Polysilsesquioxane Materials	6,417,236
7/16/2002	Active Topical Skin Protectants Using Polyoxometalates	6,420,434
8/20/2002	Active Topical Skin Protectants Using Polymer Coated Metal Alloys	6,437,005
10/29/2002	Active Topical Skin Protectants	6,472,437
10/29/2002	Active Topical Skin Protectants Containing S-330	6,472,438
4/29/2003	Free Floating Cryostat Sections for Use in Light and Electronic Microscopy	6,555,334
10/28/2003	Method for Self-Detection of Pupillary Response	6,637,885
	U.S. Army Research Institute of Environmental Medicine	
4/27/1993	Doppler Radar/Ultrasonic Hybrid Height Sensing System	5,206,652*
5/16/1995	Pneumatic Winch	5,415,379*
11/4/1997	Vigilance Monitor System	5,682,882
4/14/1998	Antisense Oligonucleotides Specific for the Muscarinic Type 2 Acetylcholine Receptor mRNA	5,739,119
8/15/2000	Apparatus and Method for Measuring the Relative Velocity and True Distance between Two Objects	6,104,671
12/3/2002	Apparatus for Lifting or Pulling a Load	6,488,267
12/30/2003	Temperature-Regulated Cell Perifusion Chamber	6,670,170
	U.S. Army Medical Research Institute of Infectious Diseases	
7/30/1985	Antitrypanosomal Activity Coordination Compounds	4,532,122*
2/9/1993	cDNA Clone Coding for Venezuelan Equine Encephalitis Virus and Attenuating Mutations Thereof	5,185,440

Date Issued	Title of Patent	Patent Number
	U.S. Army Medical Research Institute of Infectious Diseases (cont.)	
3/29/1994	Nucleotide Sequences Encoding the Expression of a Hantaan Virus Nucleocapsid Protein and G1 and G2 Glycoproteins	5,298,423
6/14/1994	Small Animal Restraint Device	5,320,069*
9/26/1995	Vaccine against Ricin Toxin	5,453,271
4/9/1996	Attenuating Mutations in Venezuelan Equine Encephalitis Virus	5,505,947
3/25/1997	Hantavirus Vaccine	5,614,193
5/6/1997	Monoclonal Antibody against Ricin A Chain	5,626,844
7/1/1997	Method of Inducing an Immune Response with a Live Venezuelan Equine Encephalitis Virus Expressing a Heterologous Immunogen	5,643,576
8/11/1998	Alphavirus RNA Replicon Systems	5,792,462
9/15/1998	Protective Monoclonal Antibody against Botulinum Neurotoxin Serotype F	5,807,741
10/12/1999	Assay for the Proteolytic Activity of Serotype A from *Clostridium botulinum*	5,965,699
12/28/1999	Method for Purifying Cholera Toxin	6,008,329
4/2/2000	Flow-Through Cell Culture Chamber	6,046,806
12/5/2000	Alphavirus RNA Replicon Systems	6,156,558
3/13/2001	Genetic Induction of Anti-viral Immune Response and Genetic Vaccine for Filovirus	6,200,959
7/10/2001	DNA Vaccines against Tick-Borne Flaviviruses	6,258,788
7/17/2001	Overcoming Interference in Alphavirus Immune Individuals	6,261,567
7/17/2001	Live Attenuated Virus Vaccines for Western Equine Encephalitis Virus, Eastern Equine Encephalitis Virus, and Venezuelan Equine Encephalitis Virus IE and IIIA Variants	6,261,570
9/11/2001	Protective Peptides of Neurotoxin of *C. botulinum*	6,287,566
10/2/2001	Live Attenuated Venezuelan Equine Encephalitis Vaccine	6,296,854
11/13/2001	A Sporogenic *B. anthracis* Expression System	6,316,006
5/14/2002	Method of Making a Vaccine for Anthrax	6,387,665
6/4/2002	Bacterial Superantigen Vaccines	6,399,332
6/18/2002	Dip-Stick Assay for C-Reactive Protein	6,406,862
9/17/2002	Prophylactic and Therapeutic Monoclonal Antibodies	6,451,309
12/17/2002	Botulinum Neurotoxin Vaccine	6,495,143
2/11/2003	Marburg Virus Vaccines	6,517,842
2/18/2003	Alphavirus RNA Replicon Systems	6,521,235
3/11/2003	Alphavirus RNA Replicon Systems	6,531,135

Date Issued	Title of Patent	Patent Number
	U.S. Army Medical Research Institute of Infectious Diseases (cont.)	
4/1/2003	Alphavirus RNA Replicon Systems	6,541,010
5/13/2003	DNA Vaccines against Poxviruses	6,562,376
9/16/2003	Prophylactic and Therapeutic Monoclonal Antibodies	6,620,412
10/7/2003	Monoclonal Antibodies to Ebola Glycoprotein	6,630,144
10/14/2003	Vaccine against Staphylococcus Intoxication	6,632,640
12/23/2003	Antibodies against Type A Botulinum Neurotoxin	6,667,158
3/30/2004	Bacterial Superantigen Vaccines	6,713,284
7/13/2004	High Through-Put Assays for the Proteolytic Activities of Clostridial Neurotoxins	6,762,280
	Walter Reed Army Institute of Research	
11/4/1969	Two-Dimensional Structure Encoding Typewriter	3,476,311*
7/27/1971	2-(Phenylalkylamino) Ethanethio-Sulfuric Acids as Antiradiation Agents	3,595,899*
8/3/1971	Method of Synthesizing Selenoureas from Thioureas	3,597,444*
8/17/1971	Alpha-Dilower Alkyl Amino-2,6,-DI-[p-Chlorophenyll-4-Pyridine Methanols and Derivatives Thereof	3,600,396*
12/21/1971	Alpha-Adrenergic Blocking Agents	3,629,410*
1/18/1972	Meningococcal Polysaccharide Vaccines	3,636,192*
4/11/1972	Synthesis of N-Substituted 2-Amino-Ethanethio-Sulfuric Acids	3,655,715*
6/6/1972	Surgical Clamp	3,667,471*
8/21/1973	Trifluoromethyl Substituted-2, 6-Diphenyl-4-Pyridyl Carbinolamine Antimalarials	3,753,997*
10/2/1973	2,6-Bis-Trifluoromethyl-Phenyl-4-Pyridinecarboxylic Acid and Derivatives Thereof	3,763,148*
10/9/1973	4-Pyridylcarbinolamine Anti-malarials	3,764,604*
5/27/1975	2-Aryl-6-Trifluoromethyl-4-Pyridyl-Carbinolamines Antimalarials	3,886,167*
2/24/1976	2-Substituted Phenyl-6-Trifluoromethyl-4-Pyridyl-Carbinolamines	3,940,404*
4/27/1976	2-Aryl-6-Trifluoromethyl-4-Pyridyl-Carbinolamines Antimalarials	3,953,463*
6/8/1976	Comparator Circuit for Automatic Analysis Apparatus	3,961,898*
1/16/1979	Microwave Time Delay Spectroscopic Methods and Apparatus for Remote Interrogation of Biological Threats	4,135,131*
4/3/1979	Thermometric Transducer Device	4,148,005*

Date Issued	Title of Patent	Patent Number
	Walter Reed Army Institute of Research (cont.)	
7/24/1979	Ridged Waveguide Antenna Submerged in Dielectric Liquid	4,162,500*
1/29/1980	Liposome Carriers in Chemotherapy of Leishmaniasis	4,186,183*
2/5/1980	Use of Phosphonium Salts in Treatment of African Trypanosomiasis	4,187,300*
6/24/1980	Anti-leishmanial Lepidine Derivatives	4,209,519*
12/16/1980	An Electromagnetic Method for the Noninvasive Analysis of Cell Membrane Physiology and Pharmacology	4,240,027*
1/20/1981	Calibration Method for Lumped Capacitance Measurement of Complex Permittivity at HV, VHF, and UHF Frequencies	4,246,534*
1/27/1981	Method and Apparatus for Physiologic Facsimile Imaging of Biologic Targets Based on Complex Permittivity Measurements Using Remote Microwave	4,247,815*
5/15/1981	Narcotic Antagonists in the Therapy of Shock	4,267,182*
6/2/1981	Method and Apparatus for Physiologic Facsimile Imaging of Biologic Targets Based on Using Remote Microwave Interrogation	4,271,389*
8/4/1981	Topical Prophylaxis against Schistosomiasis	4,282,253*
8/25/1981	Method for Producing a Vaccine against Bacterial Infections Caused by *Pseudomonas aeruginosa*	4,285,936*
11/10/1981	Auto-optical Centering Device for Photometers	4,299,493*
11/24/1981	Liposome Carriers in Leishmaniasis Chemotherapy with 8-Aminoquinoline Derivatives	4,302,459*
3/2/1982	2-Acetyl- and 2-Propionylpyridine Thiosemicarbazones	4,317,776*
8/31/1982	Floating Device for Density Gradient Fractionation	4,346,608*
1/18/1983	Apparatus for and Method of Testing Vision	4,368,959*
5/17/1983	Silver Metachloridine	4,384,117*
5/24/1983	2-Acetyl- and 2-Propionylpyridine Thiosemicarbazones as Antimalarials	4,385,055*
8/30/1983	Method of Treating Gonorrhea Infections with 2-Acetyl- and 2-Proprionylpyridine Thiosemicarbazones	4,401,670*
11/15/1983	Silver Metachlorodine in Treatment of Infections	4,415,565*
11/22/1983	Treatment of Malaria with Liposomes Containing 8-Aminoquinoline Derivatives and Glycoconjugates	4,416,872*
1/17/1984	Thyrotropin Releasing Hormone in Therapy of Shock as a Central Nervous System Stimulant	4,426,378*
2/17/1984	4-Methyl-5(Unsubstituted and Substituted Phenoxy)-6-Methoxy-8-[Aminoalkylamino] Quinolines	4,431,807*

Date Issued	Title of Patent	Patent Number
	Walter Reed Army Institute of Research (cont.)	
2/28/1984	Narcotic Antagonists in the Therapy of Shock	4,434,168*
4/3/1984	2-Acetyl Quinoline Thiosemicarbazones Useful in Treatment of Gonorrhea, Malaria, or Bacterial Infections	4,440,771*
4/17/1984	Neisseria Gonorrhea Vaccine	4,443,431*
5/8/1984	Sampling Device	4,447,395*
5/8/1984	Method for Treating Bacterial Infections with 2-Acetyl- and 2-Propionylpyridine Thiosemicarbazones	4,447,427*
6/12/1984	Scleral Depressor	4,453,546*
12/11/1984	Topographic Marking Device	4,488,043*
1/15/1985	Medical 2-Acetyl-and 2-Propionylpyridine Thiosemicarbazones and Preparation Thereof	4,493,930*
11/19/1985	5-(Straight Chain 3-12 Carbon Alkoxy)-8-Quinolinamines and Their Use for Treatment of Malaria	4,554,279*
4/8/1986	Suture Needle Holder	4,580,567*
5/27/1986	Sensitive Radioimmunoassay Using Antibody to L-Hyoscyamine	4,591,573*
6/24/1986	2-Acetylpyridine Thiosemicarbazones as Antiviral Agents	4,596,798*
10/14/1986	4-Methyl-5(Unsubstituted and Substituted) Phenoxy-2, 6-Dimethoxy-8-(Aminoalkylamino) Quinolines (Tafenoquine)	4,617,394*
12/20/1986	Oral Vaccine for Immunization against Enteric Disease	4,632,830
4/14/1987	Transition of Metal Complexes of the Selenium Analogs of 2-Acetyl-and 2-Propionylpyridine Thiosemicarbazones Useful for Treating Malarial Infections and Leukemia	4,657,903*
4/21/1987	Anti-leishmanial Lepidine Derivatives	4,659,708*
4/21/1987	Topical Prophylaxis against Schistosomal Infections	4,659,738*
5/12/1987	2-Acetyl- and 2-Propionylpyridine Selenosemicarbazones	4,665,173*
11/17/1987	Immunologically Active Peptides Capable of Inducing Immunization against Malaria and Genes Encoding Therefor	4,707,357
11/17/1987	Process for the Preparation of Detoxified Poly-Saccharide-Outer Membrane Protein Complexes, and Their Use as Antibacterial Vaccines	4,707,543*
12/15/1987	Azabicyloalkane Phenyl Substituted Alkane Carboxylates, Their Preparation and Use as Anticholinergic Agents	4,713,391*

Date Issued	Title of Patent	Patent Number
	Walter Reed Army Institute of Research (cont.)	
1/5/1988	Adjustable Mold for Fabricating Bone Replacements	4,717,115*
4/19/1988	2-Acetyl- and 2-Proprionylpyridine Thiosemicarbazones	4,739,069*
10/11/1988	2-Acetylpyridine Thiosemicarbazone Compositions as Antiviral Agents	4,777,166*
12/13/1988	Novel Antimalarial Dihydroartemisinin Derivatives	4,791,135*
12/27/1988	Excito-Repellency Test System	4,794,549*
2/28/1989	Method for Producing Protection in an Animal against Cyanide Poisoning Using 8-Aminoquinolines	4,808,598*
9/5/1989	Method for Detecting Phosphatidylinositol through Binding to Concanavalin A	4,863,874*
11/28/1989	Unsymmetrical Organic Disulfide Compounds Useful as Antiradiation Agents	4,883,890*
12/5/1989	Monoclonal Antibodies to Cholesterol and Methods	4,885,256
1/30/1990	Antimalarial Compositions and Methods	4,897,403*
3/6/1990	Antigenic Determinants Recognized by Antidotes Obtained Using a Pathogenic Agent or Derivative Thereof That Presents a Restricted Set of Antigens	4,906,564*
3/20/1990	Transdermal Vapor Collection Method and Apparatus	4,909,256*
7/24/1990	Unsymmetrical Organic Disulfide Compounds as Useful as Antiradiation Agents	4,952,338
7/31/1990	Oversize Laser Mailer and Return Envelope and Method	4,943,657*
8/28/1990	Carbaphens: Aprophen Analogs That Are Binary Antidotes for Organophosphate Poisoning	4,944,449*
11/27/1990	Unsymmetrical Organic Disulfide Compounds Useful as Antiradiation Agents	4,973,734*
12/18/1990	Organic Disulfide Compound Useful as Antiradiation Agents	4,978,782*
2/12/1991	Simple Conversion of Artemisinic Acid into Artemisinin	4,992,561*
3/12/1991	Phospholipid Compositions and Their Effective Use as Anti-tumor Agents	4,999,344*
3/19/1991	Device and Method for Providing Doses of a Liquid Material over Time to a Gut-Associated Lymphoid Tissue or a Test Animal	5,000,732*
4/30/1991	Unique Bone Regeneration Tricalcium Phosphate	5,011,495*
6/25/1991	Carbaphens: Aprophen Analogs That Are Binary Antidotes for Organophosphate Poisoning	5,026,897*

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	Walter Reed Army Institute of Research (cont.)	
8/6/1991	Recombinant DNA Molecules for Producing Terminal Transferase-Like Polypeptides	5,037,756
10/8/1991	Nucleic Acid Probe and Method for the Rapid Detection of Typhoid Fever Bacteria	5,055,394*
12/10/1991	Mouse Hybridoma Cell Lines Producing Antibodies Specific for *Clostridium difficile* Toxins	5,071,759*
12/24/1991	Insect Containing Test Apparatus	5,074,247*
12/31/1991	Photo Processing Work Station	5,077,570*
5/12/1992	Potentiation of Immunotoxin Action by Brefeldin A	5,112,607*
7/14/1992	Bis-Methylene Ether Pyridinium Compounds	5,130,438*
4/6/1993	Anti-microbial Mafenide-Phosphanilate Compound, Pharmaceutical Compositions and Method of Use Therefor	5,200,402*
4/13/1993	Method for Treating Leishmaniasis (NIH Rights)	5,202,320
4/20/1993	Compounds Exhibiting Antiparasitic Activity and a Method for Their Use	5,204,352*
4/27/1993	Method for the Treatment of Malaria	5,206,236
7/20/1993	Encapsulated Plant-Derived Phosphatidylinositol (PI) Compositions for the Prevention of Mitogenically-Induced Cell Proliferation	5,229,376*
8/24/1993	Hydrolytic Stabilizer for Unstable Organic Ions	5,238,927*
9/7/1993	Computer-Driven Amino Acid Indexer for Peptide Synthesis	5,243,540*
11/2/1993	Synthesis and Use of Novel [+] -3-Substituted-N-Alkylmorphinans as Anticonvulsants and/or Antiischemic Agents	5,258,386*
1/25/1994	Heterocyclic and Aromatic Thiosemicarbazones Useful in the Treatment of Filariasis	5,281,597*
3/1/1994	Alkaloids of *Picralima nitida* Used for Treatment of Protozoal Diseases	5,290,553
7/19/1994	1-Phenylalkanecarboxylic Acid Derivatives as Anticonvulsant and Neuroprotective Agents	5,331,010*
9/27/1994	Absorbable Tissue Adhesives	5,350,798
3/21/1995	Method of Lysing Thrombi	5,399,158
5/16/1995	High Efficiency Balanced Oscillating Shuttle Pump	5,415,532
5/23/1995	Vaccines against Diseases Caused by Enteropathogenic Organisms Using Antigens Encapsulated within Biodegradable-Biocompatible Microspheres	5,417,986
11/28/1995	Microsphere Drug Application Device	5,470,311
12/19/1995	Test for Quantitative Thrombin Time	5,476,771
5/6/1997	Transportable Life Support System	5,626,151
5/20/1997	Use of Sialidase Inhibitors in the Prevention and Treatment of Infectious and Inflammatory States	5,631,283

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	Walter Reed Army Institute of Research (cont.)	
8/26/1997	Drug Releasing Surgical Implant or Dressing Material	5,660,854
12/2/1997	Microparticles of Maximal Uptake Capacity by Both M Cells and Non-M Cells	5,693,343
12/9/1997	Compositions for Use to Deactivate Organophates	5,695,750
12/16/1997	Method for Production of Antigens under Control of Temperature-Regulated Promotors in Enteric Bacteria	5,698,416
1/16/1998	Extraction Process for Producing PLGA Microspheres	5,705,197
1/27/1998	Method of Treating Malaria with Desbutylhalofantane	5,711,966
2/10/1998	Solid Fat Nanoemulsions as Vaccine Delivery Vehicles	5,716,637
3/10/1998	Immuno-potentiating Systems for Preparations of Immunogenic Materials	5,726,292
4/7/1998	Infectious Japanese Encephalitis Virus cDNA Clones That Produce Highly Attenuated Recombinant Japanese Encephalitis Virus and Vaccines Thereof	5,736,148
6/9/1998	Vaccines against Intracellular Pathogens Using Antigens Encapsulated within Biodegradable Biocompatible Microspheres	5,762,965
10/13/1998	Liposomal Formulation	5,820,880
10/20/1998	Shigella Vector for Delivering DNA to a Mammalian Cell	5,824,538
3/10/1999	Encapsulated High-Concentration Lipid A Compositions as Immunogenic Agents to Produce Human Antibodies to Prevent or Treat Gram-Negative Bacterial Infections	5,888,519
6/8/1999	Transdermal Delivery System for Antigen	5,910,306
6/22/1999	Method of Raising Antibodies against *E. coli* of the Family CS4-CFA/I	5,914,114
6/29/1999	Advanced Surgical Suite for Trauma Casualties	5,916,096
6/29/1999	Peptide-Containing Liposomes, Immunogenic Liposomes and Methods of Preparation and Use	5,916,588
7/6/1999	Fiber Optic Periodontal Endoscope	5,919,129
8/17/1999	Mutants of *Brucella melitensis*	5,939,075
9/28/1999	Simple PCR Technique for Detecting and Differentiating Bacterial Pathogens	5,958,686
10/12/1999	Methods for Treating Antibiotic-Resistant Infections	5,965,572
10/26/1999	Drug Releasing Implant or Dressing Material	5,972,366
11/9/1999	Adjuvant for Transcutaneous Immunization	5,980,898

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	Walter Reed Army Institute of Research (cont.)	
11/16/1999	Lethal Mosquito Breeding Container	5,983,557
11/16/1999	Oral or Intranasal Vaccine Using Hydrophobic Complexes Having Proteosomes and Lipopolysaccharides	5,985,285
12/28/1999	Process for Making Liposome Preparations	6,007,838
4/2/2000	Compositions Having Neuroprotective and Analgesic Activity	6,046,200
5/23/2000	Use of Antibodies to Sialidase as Anti-infectious Agents and Anti-inflammatory Agents	6,066,323
6/13/2000	Recombinant Dengue Virus DNA Fragment	6,074,865
7/18/2000	Method for Production of Plasmodium Causing Relapsing Malaria	6,090,614
7/25/2000	Vaccine for Induction of Immunity to Malaria	6,093,406
8/29/2000	Immunogenic Compositions	6,110,492
8/29/2000	Method of Measuring Tumor Suppressor Gene p53	6,110,671
9/12/2000	Recombinant Vaccine Made in *E. coli* against Dengue Virus	6,117,640
9/26/2000	Protein Biomarker for Mustard Chemical Injury	6,124,108
11/21/2000	Prolonged Storage of Red Blood Cells	6,150,085
12/12/2000	Treatment or Prophylaxis of Retinal Pathology and Spinal Cord Injury	6,159,958
2/13/2001	Lethal Mosquito Breeding Container	6,185,861
2/20/2001	Method and Kit for Detection of Dengue Virus	6,190,859
4/10/2001	Diagnostic Methods for Cyclospora	6,214,548
4/17/2001	Sustained-Release Non-steroidal, Anti-inflammatory and Lidocaine PLGA Microspheres	6,217,911
6/5/2001	System and Method for Predicting Human Cognitive Performance Using Data from an Actigraph	6,241,686
6/12/2001	Invaplex from Gram Negative Bacteria, Method of Purification and Methods of Use	6,245,892
6/19/2001	Polypeptides Selectively Reactive with Antibodies against Human Immunodeficiency Virus and Vaccines Comprising the Polypeptides	6,248,574
7/3/2001	Inactivated Dengue Virus Vaccine	6,254,873
7/31/2001	Substituted Aromatic Compounds for Treatment of Antibiotic-Resistant Infections	6,268,383
8/14/2001	Methods for Treating Antibiotic-Resistant Infections	6,274,598
8/21/2001	Use of Purified Invaplex from Gram Negative Bacteria as a Vaccine	6,277,379
9/4/2001	Antileishmanial Composition for Topical Application	6,284,739

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	Walter Reed Army Institute of Research (cont.)	
9/4/2001	Indolo[2,1,b] Quinazole-6,12-Dione Antimalarial Compounds and Methods of Treating Malaria Therewith	6,284,772
10/30/2001	An Attenuated Japanese Encephalitis Virus Adapted to Vero Cells and a Japanese Encephalitis Vaccine	6,350,650
10/30/2001	Therapeutic Treatment and Prevention of Infections with Materials Encapsulated within a Biodegradable-Biocompatible Polymeric Matrix	6,309,669
10/30/2001	Sequestrin of *Plasmodium falciparum*	6,310,046
11/13/2001	Method of Diagnosing of Exposure to Toxic Agents by Measuring Distinct Pattern in the Levels of Expression of Specific Genes	6,316,197
1/15/2002	Method and Compositions for Treating and Preventing Retinal Damage	6,339,102
3/5/2002	Icon for a Portion of a Display Screen	D454,140
5/21/2002	Lethal Mosquito Breeding Container	6,389,740
6/11/2002	Antifungal and Antiparasitic Compounds	6,403,576
6/18/2002	Immobilized Enzymes Biosensors for Chemical Toxins	6,406,876
6/25/2002	Antimicrobial-Mediated Bacterial DNA Delivery	6,410,012
6/25/2002	Chemotherapeutic Treatment of Bacterial Infections with an Antibiotic Encapsulated within a Biodegradable Polymeric Matrix	6,410,056
6/25/2002	Compositions Having Neuroprotective and Analgesic Activity	6,410,537
7/16/2002	Method for Predicting Human Cognitive Performance	6,419,629
8/13/2002	Treatment of and/or Prophylaxis against Brain and Spinal Cord Injury	6,432,434
8/13/2002	Compositions Having Anti-leishmanial Activity	6,433,023
9/10/2002	Sustained Release Hydrophobic Bioactive PLGA Microspheres	6,447,796
9/10/2002	Prolonged Storage of Red Blood Cells	6,447,987
9/24/2002	Icon for a Portion of a Display Screen	D463,445
9/24/2002	Icon for a Portion of a Display Screen	D463,446
9/30/2002	Live Vaccine against Brucellosis	6,444,445
10/22/2002	Method of Treating, Preventing, or Inhibiting Central Nervous System Injuries and Diseases	6,469,049
1/28/2003	Attenuated Dengue-2 Virus Vaccine	6,511,667
2/4/2003	Recombinant Vaccine against Dengue Virus	6,514,501
3/4/2003	System and Method for Predicting Human Cognitive Performance Using Data from an Actigraph	6,527,715

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	Walter Reed Army Institute of Research (cont.)	
3/4/2003	Attenuated Dengue-3 Virus Vaccine	6,528,065
3/4/2003	Sustained Release Non-steroidal, Anti-inflammatory, and Lidocaine PLGA Microspheres	6,528,097
3/11/2003	Method and System for Predicting Human Cognitive Performance	6,530,884
3/11/2003	Indolo[2,1-b] Quinazole-6, 12-Dione Antimalarial Compounds and Methods of Treating Malaria Therewith	6,531,487
3/25/2003	Attenuated Dengue-4 Virus Vaccine	6,537,557
4/1/2003	Differentially Acting OP Detoxifying Sponges	6,541,230
4/22/2003	Method and System for Predicting Human Cognitive Performance	6,553,252
5/6/2003	Vaccine against Gram-Negative Bacteria	6,558,677
6/3/2003	Previns as Specific Inhibitors and Therapeutic Agents for Botulinum Toxin B and Tetanus Neurotoxins	6,573,244
9/2/2003	Adaptation of Virus to Vertebrate Cells	6,613,556
9/30/2003	Digital Radiographic Sensor View Capture	6,628,751
10/28/2003	Multivalent Dengue Virus Vaccine	6,638,514
11/4/2003	Sequestrin of *Plasmodium falciparum*	6,641,815
11/4/2003	Preparation of Enzymatically Active Sponges or Foams for Detoxification of Hazardous Compounds	6,642,037
11/25/2003	Chemical Information Systems	6,654,736
12/16/2003	Antivesicant Compounds and Methods of Making and Using Thereof	6,664,280
1/6/2004	Multipurpose Self-Erecting Structure Having Advanced Insect Protection and Storage Characteristics	6,672,323
1/20/2004	Invaplex from Gram Negative Bacteria, Method of Purification and Methods of Use	6,680,374
3/16/2004	Reversed Amidines and Methods of Using for Treating, Preventing, or Inhibiting Leishmaniasis	6,706,754
3/30/2004	Buforin I as a Specific Inhibitor and Therapeutic Agent for Botulinum Toxin B and Tetanus Neurotoxins	6,713,444
5/25/2004	Method for Predicting Human Cognitive Performance	6,740,032
6/1/2004	Method and System for Predicting Human Cognitive Performance Using an Actigraph	6,743,167
6/8/2004	Assay for Detecting, Measuring and Monitoring the Activities and Concentrations of Proteins and Methods of Use Thereof	6,746,850

Date Issued	Title of Patent	Patent Number
	Walter Reed Army Institute of Research (cont.)	
6/22/2004	Protein Biomarker for Mustard Chemical Injury	6,735,155
6/29/2004	Use of Lipoxygenase Inhibitors and PPAR Ligands as Anticancer Therapeutic and Intervention Agents	6,756,399
9/21/2002	Flavivirus Detection and Quantification Assay	6,793,488
9/28/2004	Use of Penetration Enhancers and Barrier Disruption Agents to Enhance the Transcutaneous Immune Response	6,797276
10/13/2004	Mass Spectrometry of Colonization Factors	6,797,485
10/5/2004	Chemosensitizing Agents against Chloroquine Resistant *P. falciparum* and Methods of Making Use Thereof	6,800,618
10/12/2004	Oral or Intranasal Vaccines Using Hydrophobic Complexes Having Proteosomes and Lipopolysaccharides	6,803,042
11/9/2004	Pharamaceutical Composition Containing pGlu-Glu-Pro-NH2 and Method for Treating Diseases and Injuries to the Brain, Spinal Cord and Retina Using Same	6,815,425
11/30/2004	Compositions for Treatment of Hemorrhaging with Activated Factor VIIa in Combination with Fibrinogen and Methods of Using Same	6,825,323
11/30/2004	Trifluoromethylepinephrine Compounds and Methods of Making and Using Thereof	6,825,382
1/18/2004	Therapeutic Treatment and Prevention of Infections with Bioactive Materials Encapsulated within a Biodegradable-Biocompatible Polymeric Matrix	6,844,010
2/1/2005	System and Method for Detecting Visual Alertness	6,849,050
2/15/2005	Isolation and Purification of *P. falciparum* Merozoite Protein-142 Vaccine	6,855,322
2/15/2005	Sustained Release Hydrophobic Bioactive PLGA Microspheres	6,855,331
3/5/2002	Icon for a Portion of a Display Screen	D454,140
9/24/2002	Icon for a Portion of a Display Screen	D463,446
3/25/2003	Attenuated Dengue-4 Virus Vaccine	6,537,557

[2] List as of March 2, 2005.

Appendix B

Recent Commercial-Off-the-Shelf (COTS) Technology Procurements

In addition to the technology development activities of the USAMRMC laboratories and the U.S. Army Medical Materiel Development Activity, USAMRMC has a medical procurement-oriented component – the U.S. Army Medical Materiel Agency. In many cases, USAMMA helps commercial vendors design and produce medical equipment items that meet military needs. Procurement of new technology has two main purposes – the modernization (upgrades) and augmentation (new capabilities) of equipment sets. The following list highlights commercial technology procurement actions for the year 2003.[1] Accelerated procurements to support Operation Iraqi Freedom demonstrated the Command's responsiveness to operational requirements.

Product Category	Product Description
Analyzer, Blood Gas/ Electrolyte	Point-of-use blood analyzer for the measurement of blood gases and electrolytes. Utilizes 2 to 3 drops of fresh whole blood in a disposable test cartridge inserted into the handheld analyzer. Results are obtained within 2 minutes, with all blood and calibrant fluid contained within the cartridge for safe biohazard disposal.
Analyzer, Clinical Chemistry	Designed for near-patient testing. Automatically performs blood tests on whole blood samples with results achieved within 15 minutes. A single-use plastic disc contains all the reagents and diluents necessary to perform a panel of up to 12 individual tests on just one sample (100 microliters) of whole blood, serum, or plasma.
Analyzer, Hematology	Automated blood analyzer offering measurements of 10 parameters, using a minimal sample volume of 12 µL of blood in whole blood mode or 20 µL of whole blood in pre-dilute mode. Results provided in less than 60 seconds.
Anesthesia Apparatus, Drawover, Portable	Simple, rugged, lightweight, drawover anesthesia device designed for use in non-rebreathing type circuits and classified as "agent non-specific."
Anesthesia Apparatus, Field	Portable field anesthesia apparatus permitting use of closed (low flow), semi-closed, and open anesthesia techniques. Interfaces with a variety of oxygen/gas sources.
Blood/Fluid Warmer (multiple)	Infuses blood or fluid warmed to physiological temperature.

Product Category	Product Description
C-Arm Systems	Enables "live" x-ray imaging to be conducted outside of the standard radiographic suite, such as in surgery or on stretchers/tables, to allow for quick diagnoses and use during surgical procedures. Use examples include digestive tract or vascular imaging, foreign body location, and for visualization of surgical instrument placement. Images are transmitted to a display monitor.
Centrifuge, Portable Lab	Microhematocrit centrifuge.
Computed Radiography (CR) System (multiple)	Multiple CR systems from high-volume to low-volume tabletop systems. Images are acquired in less than a minute with no film, no chemicals, and no disposal (environmental) issues.
Defibrillator (multiple)	Defibrillator/monitor-recorder system. Incorporates three lead ECG, adjustable delivery output range, and energy steps. One system includes cardiac pacing capability.
Dental X-Ray Unit, Handheld	Handheld dental intra-oral x-ray system with a high-frequency switching mode x-ray generator and tube housing assembly, which is designed for dental use only.
Dental X-Ray Imaging, Digital	Lightweight, filmless imaging system that captures, stores, and allows for viewing of dental x-ray images on a screen rather than film.
Electrosurgical Apparatus (multiple)	Electrosurgical units provide cutting and coagulation capability. Monopolar, bipolar, and micropolar outputs and a variety of settings for optimum control of cutting and hemostasis during cutting. Return electrode monitoring to reduce risk of patient burns.
Oximeter, Pulse (multiple)	Small, versatile pulse oximeter provides assessment of blood oxygen saturation and pulse rate. Flexibility allows for use in an array of medical locations including transport.
Oxygen Concentrator (multiple)	Medical-grade oxygen-generation systems from large (120 lpm) down to point-of-use (0.5 to 5 lpm). Reduces logistical burden of supplying and refilling oxygen cylinders.
Oxygen Monitor	Small, lightweight monitor used in conjunction drawover anesthesia device to measure oxygen concentration.
Pump, Infusion	Multiple infusion channels for the delivery of a wide range of fluids along with secondary delivery of intermittent medications, fluid challenges, or loading doses from each channel.
Pump, Infusion (mini)	Miniature pump for controlled, rapid delivery of intravenous fluids.

Product Category	Product Description
Refrigerator, Solid-State, Biologicals	Portable refrigerator accommodates a minimum of 30 whole blood units of 450 mL each or 50 packed red blood cell units of 270 mL each. Cools by thermo-electric technology (solid-state, no moving parts) and has battery backup.
Suction Apparatus (multiple)	Continuous and variable suction apparatus.
Ultrasound, Portable	Handheld diagnostic ultrasound device for the detection of rapid triage and assessment of trauma (FAST), visualization of abdominal fluid collection, evaluation of pericardial or pleural effusions and tamponade, immediate assessment of pelvic pain and abnormal uterine bleeding, rapid evaluation of acute abdominal pain (kidney, cholelithiasis), and easy emergency obstetric exams (IUP, fetal viability).
Ventilator (multiple)	Portable ventilators.
View Box	Slide viewer and warmer. For use in blood typing, Rh determinations, warming slides for Gram's stain, tissue typing, and reading enzyme antibody screens in microplates.
Vital Signs Monitor	Rugged, lightweight, portable vital signs monitor for field use.

[1] Operational fielding data are as of March 2004.

Appendix C

Small Business Innovation Research (SBIR) Phase II Projects

The SBIR Program is a Congressionally mandated program that was established in 1982 to increase the participation of small businesses in federal research and development (R&D). The goal of the dual-use SBIR Program is to tap into the innovativeness and creativity of the small business community to help meet government R&D objectives. At the same time, these small companies develop technologies, products, and services that they can then commercialize through sales in the private sector or back to the government.

Successful SBIR projects move through three phases:

- Proposals are submitted against a set of topic requirements written by Army scientists and technologists and are published in an annual solicitation. Phase I is the entry point where a company proves the feasibility of its concept in 6 months for up to $70,000. An option for up to $50,000 is available to fund interim Phase I–Phase II activities if the project is selected to receive a Phase II award. Approximately 1 in 10 Phase I activities is selected for award.
- Phase II is a substantial R&D effort, up to $730,000 over 2 years, and is intended to result in a dual-use technology, product, or service. Approximately 50% of invited Phase II proposals are selected for award. The Army also has a Phase II enhancement program, titled Phase II Plus, where SBIR matching funds are provided up to $250K to allow an existing Phase II effort to be extended up to 1 year to perform additional R&D.
- Phase III, the commercialization phase, is the goal of every SBIR effort. In Phase III, the successful company markets its dual-use product or service to the government, the private sector, or both. No SBIR funding is provided in Phase III.

Current SBIR Phase II Projects and their objectives are as follows.

A03-155 TITLE: Development of Medic Blood Pack

OBJECTIVE: To develop a medic blood pack–mobile blood storage container for blood product transport and use forward of the Forward Surgical Team.

A03-158 TITLE: Enhanced Detection and High-Throughput Screening of Proteomic Signatures/Biomarkers in Neoplastic Tissue

OBJECTIVE: To design and implement a proteomics-based assay system that will incorporate sensitive quantitative detection of biomarkers with high-throughput capabilities.

A03-159 TITLE: Personal Area Network for Warfighter Physiological Status Monitoring (WPSM)

OBJECTIVE: To develop and demonstrate a wearable personal area network (PAN) to support routine, continuous ambulatory physiological status monitoring of physically active warfighters.

A03-160 TITLE: Biomonitors for Real-Time Air Toxicity Monitoring

OBJECTIVE: To develop and integrate advanced biomonitoring technology into a field-deployable platform to provide continuous, real-time monitoring for developing toxic conditions in air. The platform will identify potential health effects on deployed forces resulting from exposures to a wide array of airborne toxic chemicals.

A03-161 TITLE: Integrated Architecture for Functional Genomic Measurements

OBJECTIVE: To capitalize upon recent advances in enabling technologies in systems science and functional genomics. Specifically, we seek the development of an innovative, fully functional, locally controlled, web-enabled product for integrated analysis of De Novo and Affymetrix datasets.

A03-162 TITLE: Haptics-Optional Surgical Training System (HOSTS)

OBJECTIVE: To develop and demonstrate a computer-based HOSTS that will enable surgeons to obtain and maintain proficiency in open surgical procedures. The development and commercialization of this technology could potentially provide surgeons with more frequent and higher quality training and lead to improved diagnosis, treatment planning, and procedure rehearsal.

A03-163 TITLE: Re-Usable Intraosseous Infusion Device

OBJECTIVE: To develop a lightweight, portable, rugged, yet re-usable intraosseous infusion device that can be used by medics in the field under extreme environmental conditions, for infusion of fluids and drugs via the bone marrow. Although infusion into a specific site is not specified, based on military need, the sternum may be the preferred site.

A03-165 TITLE: Accelerated Drug Design through Computational Biology

OBJECTIVE: To enhance rational, structure-based drug design efforts by exploiting the novel technology emerging from the bioinformatics field. We seek lead compound identification through the use of computational models, specifically considering candidate proteins from the malaria-causing parasite *Plasmodium falciparum* currently being studied.

A03-167 TITLE: Innovative Manufacturing Techniques for Polysaccharide-Protein Conjugate Vaccines

OBJECTIVE: To develop an economical manufacturing process, compatible with current Good Manufacturing Procedures, for production of conjugated Shigellla polysaccharide-protein vaccines.

A03-168 TITLE: Anti-microbial Nanoparticles Composed of a Magnetic Core and Covered with Photocatalytic TiO_2

OBJECTIVE: To develop a new generation of photocatalytic particles that can be applied topologically and irradiated with UV light for the purpose of disinfecting wounds. These nanoparticle photocatalysts have a magnetic core, which permits their complete removal after treatment.

A03-170 TITLE: Patient Safety Perioperative Readiness Support System

OBJECTIVE: To develop an interactive PC-based system for employment in the perioperative environment; capable of providing explicit patient tracking, monitoring of physiological data of all patients and readiness status of all relevant medical personnel and support systems. Seven key components should assist in providing a focus for this research agenda. The intent is to develop new knowledge by building on extent knowledge related to human factors and error reduction strategies.

A03-175 TITLE: Portable Test for Detection of Viruses in Arthropod Vectors

OBJECTIVE: To produce a device for rapid, portable, and cheap detection of dengue and other viruses in arthropod vectors.

A03-177 TITLE: Development of a Field Portable Mosquito Monitoring System with Attractant

OBJECTIVE: To adapt modern technology to incorporate observational monitoring software into a field portable mosquito monitoring system for common vectors of disease, such as adult *Anopheles stephensi* and *Aedes aegypti,* vectors of malaria and dengue, respectively.

A03-178 TITLE: Noninvasive Treatment of Hemorrhagic Shock

OBJECTIVE: To develop a small, simple, lightweight noninvasive device to help sustain blood pressure after cardiovascular collapse from a battlefield injury until more definitive invasive treatment is available. This can be accomplished by decreasing intrathoracic pressure through a device that can be self-applied by the injured Soldier or with assistance, if necessary.

Appendix D

List of Acronyms

List of Acronyms

2-PAM	2-Pralidoxime Chloride
3pc	Third-Party Collections Claims

A

A&VTR	Asset & Vulnerability Tracking Resource
AAS	Advanced Anticonvulsant System
aCHD	Active Component Hospital Decrement
AChE	Acetylcholinesterase
AEFSS	AMEDD Electronic Forms Support System
AESC	AMEDD Enterprise Service Center
AIMD	Architecture Integration and Management Directorate
AMEDD	Army Medical Department
AMS	Acute Mountain Sickness
APPMO	Army PACS Program Management Office
ARD	Acute Respiratory Disease
ASER	AMEDD Suicide Event Report
AST	Advanced Surgical Technologies
ATNAA	Antidote Treatment Nerve Agent Autoinjector
AVA	Anthrax Vaccine Adsorbed
AVS	Aidman Vision Screener

B

BCT	Brigade Combat Teams
BMIST	Battlefield Medical Information System Telemedicine
BOP	Blast Overpressure
BW	Biological Warfare

C

CANA	Convulsant Antidote for Nerve Agent
CAT	Combat Application Tourniquet
CBRNE	Chemical, Biological, Radiological/Nuclear and Explosive
CBT	Computer Based Training
CCE	Coding Compliance Editor
CCFP	Combined Camouflage Face Paint
CDMRP	Congressionally Directed Medical Research Programs
CEP	Communications Earplug
CFLCC	Coalition Forces Land Component Command
CHCS II	Composite Health Care System II
CHD	Centralized Help Desk
CI	Cartledge Infuser
CIMERC	Civilian Medical Response Center

	CIMIT	Center for Integration of Medicine and Innovative Technology
	CISD	Critical-Incident Stress Debriefing
	COG	Ceramic Oxygen Generator
	CONUS	Continental United States
	CSEA	Combat Support Equipment Assessment
	cSLAM	Cellular Signalling Leukocyte Activating Molecule
	CT	Computed Tomography
	CW	Chemical Warfare
	CWA	Chemical Warfare Agents
D	DCDD	Directorate of Combat and Doctrine Development
	DEFTOS	Dental Field Treatment and Operating System
	DEPMEDS	Deployable Medical Systems
	DHF	Dengue Hemorrhagic Fever
	DIN-PACS	Digital Imaging Network-Picture Archiving and Communication System
	DMHRSi	Defense Medical Human Resources System-Internet
	DMLSS	Defense Medical Logistics Standard Support
	DoD	Department of Defense
	DREAMS	Disaster Relief and Emergency Medical Services
	DTRA	Defense Threat Reduction Agency
	DTV	Dengue Tetravalent Vaccine
E	EEE	Eastern Equine Encephalitis
	EFDS	Enhanced Fluid and Nutrition Delivery System
	eFOIA	Electronic Freedom of Information Act
	EIC	Electronic Information Carrier
	EMS	Emergency Medical Services
	EMT	Emergency and Military Tourniquet
	EMT	Emergency Medical Technician
	ESB	Environmental Sentinel Biomonitor
	ESSENCE	Electronic Surveillance System for Early Notification of Community Based Epidemics
	ETEC	Enterotoxigenic *Escherichia coli*
	EUL	Enhanced Use Lease
F	FCBC	Field Management of Chemical and Biological Casualties
	FDA	U.S. Food and Drug Administration
	FDDMTF	Forward-Deployed Digital Medical Treatment Facility
	FFW	Future Force Warrior

FIBWA	Field Identification of Biological Warfare Agents
FIRM	Fatigue Intervention and Recovery Model
FMOGDS	Field Medical Oxygen-Generating and Distribution System
FMSS	Future Medical Shelter System
FOIA	Freedom of Information Act
FPPT	Fatigue Performance Prediction Tool
FST	Forward Surgical Team

G

GA	Tabun
GB	Sarin
GD	Soman
GF	Cyclosarin
GEIS	Global Emerging Infections System
GSK	GlaxoSmithKline

H

HBOC	Hemoglobin-Based Oxygen Carrier
HBuChE	Human Butyrylcholinesterase
HBV	Hepatitis B Vaccine
HD	Sulfur Mustard
HEV	Hepatitis E Virus
HFRS	Hemorrhagic Fever with Renal Syndrome
HIV	Human Immunodeficiency Virus
HM-CBRNE	Hospital Management of Chemical, Biological, Radiological/Nuclear and Explosive Incident Course
HMD	Helmet-Mounted Display
HR	Human Resources
HSDA	Head-Supported Device
HSDA	Heat Strain Decision Aid

I

IA	Information Assurance
IAVA	Information Assurance Vulnerability Alert
IAVM	Information Assurance Vulnerability Management
IM	Information Management
IMCC	Intermittent Microclimate Cooling
INATS	Improved Nerve Agent Treatment System
IND	Investigational New Drug
IT	Information Technology
ITD	Impedance Threshold Device
IV	Intravenously

J

JBAIDS	Joint Biological Agent Identification and Diagnostic System
JE	Japanese Encephalitis
JPMO	Joint Product Management Office
JTF	Joint Task Force
JVAP	Joint Vaccine Acquisition Program

L

LSTAT	Life Support for Trauma and Transport

M

MANAA	Medical Aerosolized Nerve Agent Antidote
MAP	Mitigation Action Plan
MC4	Medical Communications for Combat Casualty Care
MCBC	Management of Chemical and Biological Casualties
MCC	Microclimate Cooling
MCDRP	Medical Chemical Defense Research Program
MEDCOM	U.S. Army Medical Command
MEM	MEDCOM Enterprise Management
MHS	Military Health System
MIDRP	Military Infectious Diseases Research Program
MILCON	Military Construction
MITS	Medical Identification & Treatment Systems
MM&S	Medical Modeling and Simulation
MOMRP	Military Operational Medicine Research Program
MOPP	Mission-Oriented Protective Posture
MOS	Military Occupational Specialty
MRDD	Malaria Rapid Diagnostic Device
MRE	Meal, Ready-to-Eat
MSTI	Medical Simulation Training Initiative
MTF	Military Treatment Facility
MUSTPAC 3	Medical Ultrasound, Three-Dimensional, Portable with Advanced Communications
MV-E	Medical Vehicle - Evacuation
MV-T	Medical Vehicle - Treatment

N

NAAK	Nerve Agent Antidote Kit
NBC	Nuclear, Biological, and Chemical
NHP	Nonhuman Primate
NIAID	National Institute of Allergy and Infectious Diseases
NIH	National Institutes of Health
NIVDS	Nexus IV Delivery System
NMRC	Naval Medical Research Center
NOS EM	Network Operating System and Electronic Messaging

O

OCONUS	Outside the Continental United States
OP	Organophosphorus Compound
OR	Operating Room

P

PACS	Picture Archive and Communications Systems
PDA	Personal Digital Assistant
PFB	Pseudofolliculitis Barbae
PIC	Personal Information Carrier
PM	Program Manager
P/PDHA	Pre-/Post-Deployment Health Assessment
PRIDE	Psychological Readiness in a Deployed Environment
PSAOG	Pressure-Swing Adsorption Oxygen Generator
PVT	PDA-Based Psychomotor Vigilance Test

R

R&D	Research and Development
R4	Right Care to the Right Casualty at the Right Location and Right Time
rNAPC2	Recombinant Nematode Anticoagulant Protein C2
rPA	Recombinant Protective Antigen
RT-PCR	Reverse Transcriptase-Polymerase Chain Reaction
RVPSOG	Rotary Valve Pressure Swing Oxygen Generator

S

S&T	Science and Technology
S3	Surgery Scheduling System
SA	Systems Architecture
SBIR	Small Business Innovation Research
SDC	Sample Data Collection Program
SEA/B	Staphylococcal Enterotoxin A/B
SERPACWA	Skin Exposure Reduction Paste against Chemical Warfare Agents
SITU	Smallpox Inoculation Training
SMART-HS	Special Medical Augmentation and Response Teams-Health Systems
SMEED	Special Medical Emergency Evacuation Device
SNAPP	Soman Nerve Agent Pretreatment Pyridostigmine
SOFMH	Special Operations Forces Medical Handbook
STATCare	Simulation Technologies for Advanced Trauma Care
STD	Sexually Transmitted Disease
STTR	Small Business Technology Transfer

T

TAIHOD	Total Army Injury Health and Occupational Database
TALSS	Transportable Automated Life Support System
TARA	Technology Assessment and Requirements Analysis

TATRC	Telemedicine and Advanced Technology Research Center
TBE	Tick-Borne Encephalitis
TBPS	Thawed Blood Processing System
TGAS	Toxic Gas Assessment Software
TMDE	Test, Measurement, and Diagnostic Equipment
TMIP	Theater Medical Information Program
TPOCS	Third-Party Collections System
TRADOC	Training and Doctrine Command
TTS	Theater Trauma System
TURP	Transurethral Resection of the Prostate

U

UCAPERS	Uniform Chart of Account – Personnel Utilization System
UEx	Unit of Employment x
UEy	Unit of Employment y
URL	USAMMA Revolution in Logistics
USAARL	U.S. Army Aeromedical Research Laboratory
USACEHR	U.S. Army Center for Environmental Health Research
USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
USAHFPA	U.S. Army Health Facility Planning Agency
USAISR	U.S. Army Institute of Surgical Research
USAMITC	U.S. Army Medical Information Technology Center
USAMMA	U.S. Army Medical Materiel Agency
USAMMCE	U.S. Army Medical Materiel Center-Europe
USAMMDA	U.S. Army Medical Materiel Development Activity
USAMRD	U.S. Army Medical Research Detachment
USAMRICD	U.S. Army Medical Research Institute of Chemical Defense
USAMRMC	U.S. Army Medical Research and Materiel Command
USAMRU-E	U.S. Army Medical Research Unit-Europe
USARIEM	U.S. Army Research Institute of Environmental Medicine

V

VEE	Venezuelan Equine Encephalitis
VIG	Vaccinia Immune Globulin
VLP	Virus-Like Particle
VNC	Video Network Center
VR	Russian V-agent
VX	O-ethyl-S-[2(diisopropylamino)ethyl] methylphosphonothioate

W

WEE	Western Equine Encephalitis
WHO	World Health Organization
WPSM	Warfighter Physiologic Status Monitoring
WRAIR	Walter Reed Army Institute of Research